OPERATION AND MAINTENANCE MANUAL

MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM AND WASTEWATER TREATMENT PLANT

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ACRONYMS AND ABBREVIATIONS

BTEX	Benzene, toluene, ethylbenzene, and xylene
COC	Chain-of-custody
DC	Direct current
DNAPL	Dense nonaqueous-phase liquid
DQO	Data quality objectives
EPA	U.S. Environmental Protection Agency
ft^3	Cubic feet
FE	Flow element
FT	Flow transmitter
GAC	Granular activated carbon
gpm	Gallons per minute
HDPE	High-density polyethylene
HOA	HAND-OFF-AUTO
HVAC	Heating, ventilation, air conditioning
LC	Level controller
LDEQ	Louisiana Department of Environmental Quality
LDS	Leak detection system
LE	Level element
LF	Level float
LI	Level instrument
LIC	Level instrument controller
LNAPL	Light nonaqueous-phase liquids
LPAC	Liquid-phase activated carbon
LT	Level transmitter
mA	Milliamp
MCW	Madisonville Creosote Works
mm	Millimeter
MS/MSD	Matrix spike and matrix spike duplicates
NAPL	Nonaqueous-phase liquid
O&M	Operation and maintenance
OWS	Oil-water separator
%R	Percent recovery
PLC	Programmable logic controller
PPE	Personal protective equipment
psi	Pounds per square inch
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RA	Remedial action
RF	Radio frequency
SOP	Standard operating procedures
V	Volt

ACRONYMS AND ABBREVIATIONS (Continued)

VFD	Variable frequency drives
VOA	Volatile organic analysis
VOC	Volatile organic compounds
VPAC	Vapor-phase activated carbon
WWTP	Wastewater treatment plant

1.0 INTRODUCTION

This operation and maintenance (O&M) manual was prepared for the U.S. Environmental Protection Agency (EPA) for use at the Madisonville Creosote Works (MCW) Superfund Site located in Madisonville, Louisiana. The Louisiana Department of Environmental Quality (LDEQ) official site name is "Madisonville Wood Preservers" site, Agency Interest (AI) No. 6229. The EPA official site name is "Madisonville Creosote Works Superfund Site," AI No. 6229.

The system includes a dense nonaqueous-phase liquid (DNAPL) recovery system and wastewater treatment plant (WWTP). The MCW O&M manual contains: (1) operating conditions, (2) design and equipment data, (3) system operating and maintenance procedures, (4) records to be maintained, (5) personnel requirements, and (6) safety requirements.

The O&M manual is divided into six chapters, based on the guidelines and requirements established by the U.S. Environmental Protection Agency (EPA). Chapter 1 provides an introduction and general overview of the system. Chapter 2 describes the DNAPL recovery system and WWTP equipment and its operation. Chapter 3 describes routine maintenance and inspection requirements, long term procedures, and the ground water monitoring program for the DNAPL recovery system and WWTP. Chapter 4 describes recordkeeping requirements. Chapter 5 presents the personnel requirements. Chapter 6 describes the health and safety procedures to be implemented.

Appendix A contains equipment O&M manuals and data sheets that supplement the information presented in Chapters 2 and 3. Maintenance and inspection records for each piece of equipment are included as Appendix B. As-built design drawings referenced throughout the O&M are included as Appendix C. Field sampling standard operating procedures (SOP) to be used for the collection of ground water and WWTP effluent are included in Appendix D.

The MCW DNAPL recovery system and WWTP is designed to remove DNAPL from a network of 10 horizontal recovery trenches and associated vertical risers. The purpose of the DNAPL recovery system is to remove DNAPL from the sand lens without removing the associated ground water; however, some ground water will inevitably be recovered, particularly if the extraction pumps are operated based upon the water level in each riser. Although light nonaqueous-phase liquids (LNAPL) are not expected to be encountered, downstream components of the WWTP have been designed to handle this contingency. The DNAPL recovery system is designed to operate at low or intermittent flow rates for a maximum of 30 years.

A vertical riser is located at the low end of each of the 10 horizontal recovery trenches. The risers are paired in a series of five underground concrete vaults. Each riser has a progressive cavity pump used to extract liquids from the recovery system, an ultrasonic level meter used to measure ground water elevation in the riser, and a radio frequency (RF) level meter used to measure the DNAPL-ground water interface in the riser. A control panel, located in the WWTP Control Room, houses the pump controls. The pumps can be operated manually or automatically, based on predetermined set points from the ultrasonic or RF level meters. DNAPL is conveyed from the downhole risers to the WWTP through a double-walled transfer system that is equipped with a leak detection system.

The WWTP consists of an equalization tank (T-1), an oil-water separator (OWS) (T-2), and an OWS effluent tank (T-7); dense nonaqueous-phase liquid (DNAPL) storage tank (T-3) and a light nonaqueous-phase liquid (LNAPL) storage tank (T-5); three sand filters; two carbon adsorption tanks for liquid-phase treatment; two vapor carbon canisters for vapor treatment; a backwash tank (T-6); and numerous associated pumps, valves, level indicators, and flow meters. The purpose of the WWTP is to separate recovered DNAPL, LNAPL, and ground water into separate phases for on-property storage or discharge (ground water) and off-property disposal (DNAPL and LNAPL). The WWTP system (see Section 2.0) can be operated in three modes:

- In Mode 1, liquid consisting of a highly concentrated DNAPL solution from all 10 downhole pumps (P-1 through P-10) will enter the WWTP at a maximum rate of 5 gallons per minute (gpm).
- In Mode 2, liquid consisting of a low concentration mixture of DNAPL and water from all 10 downhole pumps (P-1 through P-10) will enter the WWTP at a maximum rate of 5 gpm.
- In Mode 3, liquid consisting of trace concentrations of DNAPL in recycled WWTP effluent will enter the WWTP at a rate between 120 and 150 gpm, should on-site storage of

WWTP effluent be utilized or should stormwater or other liquids accumulate in the decontamination pad.

The basic understanding of the system and its design provided in this O&M manual will assist facility personnel in coping with different conditions as they occur. This O&M manual describes the most probable operating conditions at the facility; however, conditions not described here can occur. Therefore, it will be necessary to amend these procedures as different conditions are encountered during the operation of the DNAPL recovery system and WWTP. O&M personnel should use industry standards and manufacturers literature to supplement the operating instructions and procedures described in the following chapters. The manual is bound in such a manner to facilitate this updating.

This manual should remain on site and be located in a place that is easily accessible to operating and maintenance personnel at all times.

2.0 DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM AND WASTEWATER TREATMENT PLANT OPERATION

This chapter describes in detail the components of the MCW DNAPL recovery system and WWTP and the operating parameters for the various components and presents the system maintenance requirements.

2.1 DESIGN AND EQUIPMENT DATA

The MCW DNAPL recovery system and WWTP is designed to remove DNAPL from a network of 10 horizontal recovery trenches and associated vertical risers (see Drawings C-10, C-15, C-20, and C-22 through C-26). The DNAPL recovery system is designed to remove DNAPL from the sand lense with minimal volume of associated ground water. However, should DNAPL recharge rates become such that the DNAPL level set points prevent the extraction pumps from running every few days, the pumps can then be set to operate based on the water level in each riser by adjusting the ON-OFF setpoints to determine how long each pump runs, and how frequently it cycles on or off. DNAPL, being heavier than water, will be the first fluid pumped from the riser when the pump cycles on. This will limit the amount of ground water that is in the wastewater being extracted in each riser. The extraction pump cycling frequency can be decreased by increasing the depth of water needed to shut the pump off.

A vertical riser (DNAPL Riser 1 through DNAPL Riser 10) is located at the low end of each of 10 horizontal recovery trenches (see Drawings C-22 through C-27). The risers are paired in a series of five underground concrete vaults (Risers 1 and 2 in Vault 1, Risers 3 and 4 in Vault 2, and so on; see Drawing C-15). Each riser has a progressive cavity pump used to extract liquids from the recovery system; an ultrasonic level meter used to measure ground water elevation in the riser; and an RF level meter used to measure the DNAPL-ground water interface in the riser (see Drawing C-27). A control panel, located in the WWTP Control Room, houses the pump controls. The pumps can be operated manually or automatically, based on predetermined set points for either water or DNAPL depths in each riser. DNAPL is conveyed from the downhole risers to the WWTP through a 3-inch stainless-steel conduit that runs inside of a 6-inch polyvinyl chloride (PVC) pipe to the equalization tank (T-1) (see Drawing C-15 and C-27). The double-walled transfer system is equipped with a leak detection system (LDS)-1 (see Drawing C-15 and E-1).

Each component of the DNAPL recovery system and WWTP is described in the following subsections. Drawing M-2 is a process flow diagram of the DNAPL recovery system and WWTP. Drawing M-3 is a piping and instrumentation diagram of the DNAPL recovery system and WWTP. Drawing M-4 summarizes the characteristics of the equipment, level meters, flow meters, variable frequency drive, and piping. Plan views and section views of the WWTP equipment are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. As-built construction details for the WWTP building and decontamination pad, water wells, monitoring wells, and DNAPL recovery vaults are included on Drawings C-14, C-18A, C-18B, C-18C, C-19A, C-19B, and C-27.

General electrical data for the DNAPL recovery system is shown on Drawing E-1. General electrical lighting in the WWTP building is shown on Drawing E-2. General electrical wiring for the equipment in the WWTP building is shown on Drawing E-3. Other drawings related to specific pieces of DNAPL recovery system and WWTP equipment, instrumentation, and electrical power—including Drawings E-4, E-5A, E-5B, E-6, E-7, E-8, E-9, E10A, E10B, and E10C—are referenced in the sections that follow.

2.1.1 Extraction Pumps (P-1 through P-10)

Each extraction pump is a Moyno submersible progressive cavity pump capable of discharging a maximum of 0.5 gpm; therefore, the DNAPL recovery system has a maximum design capacity of about 5 gpm of DNAPL. It is anticipated that the average discharge rate for each pump will be about 0.3 gpm, which would yield an average production rate of about 3 gpm of DNAPL when all 10 extraction pumps are operating. The pumps are actuated through 1-inch drive rods that run from the top of the rotor to a drive head (see Drawing C-27). Torque is transmitted to the drive head by a sheave and belt connection from a 5-horsepower electric motor, which is also located in the vault (see Drawing E-5B). The stator portion of the pump is located at the bottom of each production string. The length of each production string corresponds to the depth each collection sump was set at during the remedial action (RA).

The progressive cavity pumps work by rotating a screw-like rotor inside a stator that is mounted to the production string. Inside the stator is an elastomeric, plastic-like material that seals against the rotor. As the rotor spins inside the stator, the high or wide sides of the rotor squeeze against the elastomer forcing the liquid progressively higher until it discharges into the 3-inch trunk line, which delivers the wastewater to the equalization tank (T-1). Should the 1-inch effluent line leading from each pump to the 3-inch trunk line become clogged, a pressure switch (transducer) located just upstream of the 1-inch braided steel line will shut down the pump to prevent damage due to excessive line pressure. When the switch "sees" greater than 250 pounds per square inch (psi) of line pressure, it will actuate causing the motor relay in the PLC panel to open, which shuts down the pump motor. When this occurs, an indicator light on the PLC panel door will illuminate for the offending well. Once the problem causing the excessive line pressure has been rectified, the pressure switch in the vault must be reset before the pump can be restarted.

A photograph of one of the DNAPL extraction pumps is included as Exhibit 1. Detailed information regarding the pumps is given in the manufacturer's O&M manuals in Appendix A.1. Information regarding the motor starters for the pumps (mounted in the control panel) is also included in Appendix A.1.

2.1.2 Dense Nonaqueous-phase Liquid Recovery System Riser Level Meters

Each riser is equipped with two different level meter systems: an ultrasonic level meter system to measure the water-air interface, or the total depth of fluid in the riser, and an RF level meter system to measure the DNAPL-water interface. These systems are described in the following subsections.

2.1.2.1 Ultrasonic Level Meters

The ultrasonic level meter systems used to measure the water-air interface in the DNAPL risers are Drexelbrook Series 506-3000 Universal Sonic level controllers using Series 406-3000 electronics. These ultrasonic level meters send a continuous 4 to 20 milliamp (mA) signal to the system programmable logic controller (PLC). The 4 to 20 mA signal represents a ratio of signal strength (measured in mA) to the distance from the top of the riser to the top of the fluid in the riser, where typically 4 mA from the transmitter would represent the bottom of the sump (no fluid in the riser), and 20 mA would represent a full riser. The PLC translates this signal into a level value that is displayed on PLC Screen F3 and F6 (see Drawing E-6).

A photograph of one of the ultrasonic level meters is included as Exhibit 2. Detailed information regarding the ultrasonic level meters is provided in the manufacturer's O&M manuals in Appendix A.2.

2.1.2.2 Radio Frequency Level Meters

The level meter systems used to measure the water-DNAPL interface in the DNAPL risers are Drexelbrook Series 506-3000 Universal III level controllers using Series 406-3000 electronics. These RF level meters send a continuous 4 to 20 mA signal to the system PLC. The 4 to 20 mA signal represents a ratio of signal strength to DNAPL depth in each riser. The PLC translates this signal into a level value that is displayed on PLC Screen F3 and F6(see Drawing E-6). The depth of DNAPL, as determined by the RF probe, is subtracted from the overall fluid level (determined by the ultrasonic probe) to determine the thickness of the water column in each riser.

A photograph of one of the RF level meters is included as Exhibit 3. Detailed information regarding the RF level meters is provided in the manufacturer's O&M manuals in Appendix A.3.

2.1.3 Dense Nonaqueous-phase Liquid Transfer Pipeline

The DNAPL transfer pipeline consists of a 3-inch, stainless-steel, inner pipeline with a 6-inch PVC outer casing. This double-walled system is a factory-assembled system made by Guardian. The DNAPL transfer pipeline collects the output from the 10 extraction pumps and discharges the product to the equalization tank (T-1) (see Drawings C-15 and C-27).

A photograph of DNAPL transfer pipeline inside one of the underground concrete vaults is included as Exhibit 5. Information regarding the transfer pipeline is provided in the manufacturer's cut sheets in Appendix A.5.

*****WARNING*****

High concentrations of DNAPL may seriously damage the PVC outer casing should a major leak occur. Activation of the LDS requires immediate attention.

2.1.4 Equalization Tank (T-1)

The equalization tank (T-1) is located inside of the WWTP at the head of the WWTP plant. The equalization tank (T-1) equalizes flow from the DNAPL recovery system and decontamination sump extraction pump prior to discharge to the OWS. The equalization tank (T-1) is rectangular, measuring 9 feet high, 8 feet wide, and 10 feet long, with a capacity of 5,400 gallons. The tank is set up to receive liquid from the DNAPL recovery system pumps (P-1 through P-10) through the DNAPL transfer pipeline. The tank is also piped to receive backwash water from the backwash tank (T-6) through the backwash pump (P-19), the gravity sand filters (F-1, F-2, and F-3), and the liquid phase activated carbon (LPAC) filters. The tank is connected to both the OWS and the DNAPL storage tank (T-3) through the OWS feed pump (P-13).

Primary separation of DNAPL and suspended solids, via gravity, from the incoming wastewater stream occurs in the equalization tank (T-1). To take advantage of this separation, Pump P-13 is connected to the equalization tank (T-1) at two separate levels. The upper connection point, with a flowline set at 4 feet above the tank bottom, allows for draw-off of wastewater with minimal inclusion of DNAPL components. The second connection, with a flow line at the bottom of the tank, allows for drawoff of concentrated DNAPL components that are pumped directly to the DNAPL storage tank (T-3). Vapors generated in the tank are vented to an activated carbon canister (C-3; see Section 2.1.12).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. Information regarding the equalization tank (T-1) is provided in the manufacturer’s cut sheets in Appendix A.6.

2.1.5 Oil-Water Separator Tank (T-2)

The OWS tank (T-2) is the secondary treatment unit in the WWTP. The OWS tank (T-2) separates DNAPL and LNAPL constituents not removed from the wastewater entering the equalization tank (T-1) from the field extraction pumps. The OWS tank (T-2) is a closed-top, rectangular tank measuring 7.2 feet high, 5.4 feet wide, and 9.3 feet long. The OWS is equipped with a 133-gallon DNAPL chamber sump which contains the stainless steel coalescing pack, 71-gallon LNAPL chamber, and 460-gallon effluent chamber; the OWS is rated to treat up to 150 gallons per minute. Wastewater from the equalization tank (T-1) first flows into the DNAPL chamber of the OWS. Inside this chamber are a series of thin corrugated stainless steel plates that provide a large surface area upon which the NAPL constituents collect and coalesce. As the constituent droplets grow in size, they eventually reach a point where the LNAPL constituents will float to the surface and the DNAPL constituents will sink into the collection sump. The water that passes through this chamber flows over a series of weirs until reaching the effluent chamber of the OWS. As the water collects, the level eventually rises and begins to flow under the force of gravity into the OWS effluent tank (T-7). DNAPL collected in the DNAPL chamber of the OWS is removed from the OWS tank (T-2) by the DNAPL sump pump (P-14). DNAPL collected and removed from the equalization tank (T-1) via Pump P-13 utilizes the same line to transfer DNAPL to the DNAPL storage tank (T-3). Both pumps are piped to deliver DNAPL components to the DNAPL storage tank (T-3) (see Section 2.1.7). LNAPL collected in the LNAPL chamber of the OWS flows by gravity to the LNAPL storage tank (T-5) (see Section 2.1.8). Vapors collected in the OWS tank (T-2) are vented to an activated carbon canister (C-3; see Section 2.1.12).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. Detailed information regarding the OWS is provided in the manufacturer’s O&M manuals in Appendix A.7.

2.1.6 Oil-Water Separator Effluent Tank (T-7)

Water separated from the NAPL constituents in The OWS tank (T-2) flows via gravity from T-2 to the OWS effluent tank (T-7). The OWS effluent tank (T-7) is a horizontal cylindrical tank 6 feet long by 4 feet in diameter with a capacity of 550 gallons. At predetermined levels in the OWS effluent tank (T-7), Pump P-15 pumps stored wastewater from the OWS effluent tank (T-7) to the sand filters (Filters F-1, F-2, and F-3).

2.1.7 Dense Nonaqueous-phase Liquid Storage Tank (T-3)

The DNAPL storage tank (T-3) is used to store DNAPL that has been separated from the influent stream in the equalization tank (T-1) and the OWS tank (T-2). The DNAPL tank (T-3) is a horizontal cylindrical tank 11 feet long by 4 feet in diameter with a capacity of 1,000 gallons. DNAPL is pumped from the DNAPL storage tank (T-3) by the DNAPL transfer pump (P-17) to a quick-connect port outside of the WWTP for off-property disposal. Vapors collected in the tank are vented to an activated carbon canister (C-4; see Section 2.1.12).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. Information regarding the DNAPL storage tank (T-3) is provided in the manufacturer's cut sheet in Appendix A.8.

2.1.8 Light Nonaqueous-phase Liquids Storage Tank (T-5)

The LNAPL storage tank (T-5) is used to store LNAPL that has been separated from the influent stream in the OWS tank (T-2). The LNAPL storage tank (T-5) is a horizontal cylindrical tank that is 5 feet long by 3 feet in diameter with a capacity of 250 gallons. LNAPL is removed from the LNAPL storage tank (T-5) by the LNAPL transfer pump (P-16) to a quick-connect port outside of the WWTP for off-property disposal. Vapors collected in the tank are vented to an activated carbon canister (C-3; see Section 2.1.12).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. An overhead photograph showing the equalization tank (T-1), the OWS tank (T-2), and the LNAPL storage tank (T-5) is included as Exhibit 6. Information regarding the LNAPL storage tank (T-5) is provided in the manufacturer's cut sheet in Appendix A.9.

2.1.9 Sand Filters

Accumulated water in the OWS effluent tank (T-7) is pumped to one or more sand filters (F-1, F-2, or F-3) by the OWS effluent tank outlet pump (P-15). The sand filters remove suspended solids from the wastewater stream. The three vessels are connected in parallel and each measure 48.5 inches in diameter by 72 inches tall. Each unit contains about 14 cubic feet (ft^3) of gravel for support media and 27 ft^3 of

10 micron (0.85 millimeter) silica sand for the filtration media. Each vessel is valved independently to allow bypass for servicing without interrupting the WWTP system operation.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of one of the sand filters is included as Exhibit 7. Detailed information regarding the sand filters is provided in the manufacturer's O&M manuals in Appendix A.10.

2.1.10 Liquid-phase Activated Carbon Units

Effluent from the sand filter(s) is pumped to two LPAC units. The LPAC units are piped to allow operation in parallel or series, allowing continuous operation of the WWTP system during media change out and alternation of the lead-lag orientation of the units. Each LPAC unit consists of an 88-ft^3 (658 gallons) upright vessel capable of storing a maximum of 2,800 pounds of granular activated carbon (GAC).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of the LPAC units is included as Exhibit 8. Detailed information regarding the LPAC units is provided in the manufacturer's O&M manuals in Appendix A.11.

2.1.11 Backwash Tank (T-6)

The backwash tank (T-6) is used to store treated water from the LPAC units for use in backwashing the sand filter and LPAC units (see Section 2.1.9). The backwash tank (T-6) is a vertical cylindrical tank that is 8 feet tall by 6 feet in diameter and has a capacity of 5,500 gallons. Backwash water is removed from the backwash tank (T-6) by the backwash pump (P-19). Effluent from the backwash tank (T-6) drains by gravity through flow meter F-12 to either a discharge line in the North Ditch, or can be connected to a temporary storage device by employing 3-inch flex hose equipped with cam-lock fittings connected to the backwash tank manifold located outside on the northwest corner of the WWTP building.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of the manifold is included as Exhibit 4. Information regarding the backwash tank (T-6) is provided in the manufacturer's cut sheet in Appendix A.12.

2.1.12 Vapor-phase Activated Carbon Canisters

Vapors from the equalization tank (T-1), the OWS tank (T-2), and the LNAPL storage tank (T-5) are vented to vapor-phase activated carbon (VPAC) canister C-3. Vapors from Tank the DNAPL storage tank (T-3) are vented to VPAC canister C-4. Each VPAC unit consists of 250 pounds (55 gallons) of GAC. Effluent from the VPAC canisters is vented to the atmosphere outside the WWTP building.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of one of the VPAC units is included as Exhibit 9. Detailed information regarding the VPAC units is provided in the manufacturer's O&M manuals in Appendix A.13.

2.1.13 Pumps

The WWTP includes eight permanent pumps of various models, sizes, capacities, and modes of operation.

Pumps P-13 and P-15 are Albin positive displacement rotary lobe pumps (Baldor 2-horsepower [hp] motors). The speed of Pump P-13 can be remotely manipulated using the variable frequency drive (VFD) located in the PLC panel (see Section 2.1.23).

Pumps P-11, 14, 16, 17, and 19 are centrifugal pumps manufactured by Price (Baldor motors). Pump P-12 is manufactured by ABS. With the exception of pumps P-11 (the storm water sump pump during the RA) and P-12 (used as the decontamination area sump pump during the RA), all of the remaining pumps are located in the WWTP building and function in the operation of the treatment plant. Pumps P-12, P-16, P-17, and P-19 can be operated manually only. Pumps P-13, P-14, and P-15 can be operated manually or automatically from the PLC. Pump P-12 is piped to extract liquids from either the decontamination pad sump or external storage vessels, such as a frac tank, to the equalization tank (T-1). Pump details are provided on Drawing M-4.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of one of the rotary lobe pumps is included as Exhibit 10. A photograph of one of the centrifugal pumps is included as Exhibit 11. Detailed information regarding the pumps is provided in each of the manufacturer's O&M manuals and cutsheets in Appendixes A.14, A.15, and A.16. These appendices also include information regarding the motor starters for the pumps.

2.1.14 Level Meters

Several different level meter systems are used to electronically and manually monitor liquid levels in the various WWTP vessels.

The liquid level in the equalization tank (T-1) is measured using both ultrasonic and RF probe electronics. The overall fluid level, or liquid-air interface, is determined using an ultrasonic level meter (LE/LT-13) equipped with a Burkert ultrasonic level transmitter type 8175/8170. The DNAPL level in the equalization tank (T-1) is determined by a Drexelbrook series 509-7X Universal III Transmitter with HART Protocol using series 409-1000 electronics and 406-6300 Cote-Shield electronics (probe). The probe determines how much water is sitting above the segregated DNAPL components by measuring the difference in capacitance between the two fluids. The depth of DNAPL is then defined at the PLC by subtracting how much water is on the probe from the total fluid level in T-1 as determined by the ultrasonic probe. The math is conducted in the programming logic within the PLC, and is displayed accordingly on the PLC display panel.

High level alarms in the DNAPL storage tank (T-3) and the LNAPL storage tank (T-5) are provided by Drexelbrook series 506-6000 LCS Point Level Control units using series 406-6000, 406-6100, and 406-6300 Cote-Shield electronics. These contact probes should be used by the operator as an indicator that a full-tank condition exists, requiring prompt attention. The high alarm condition, when actuated, is indicated visually and by a red indicator light in the immediate vicinity of each tank, and audibly by switchable (On/Off) audible alarm box. These alarms will also be indicated on the PLC panel.

The water-DNAPL depth in the influent tank of the OWS is determined by a probe connected to a Drexelbrook series 509-7X Universal III Transmitter with HART Protocol using series 409-1000 electronics. As with all electronic instruments at the site, the transmitter is powered by a 24-volt (V) direct current (DC) transformer located within the PLC panel. Levels are determined (translated) based upon the current returned to the PLC from the transmitter, varying from 4 to 20 mA. Typically, the PLC interprets 4 mA as 0 Feet, and 20 mA as being full, or the maximum level preset into each transmitter. These preset levels can be altered at each transmitter or from the PLC panel analog board using the HartWin software installed on a laptop, but such actions should only be conducted by a qualified technician.

Overflow protection in the equalization tank (T-1), the DNAPL storage tank (T-3), the LNAPL tank (T-5), and the OWS effluent tank (T-7) is provided using point level float switches. Each switch includes a stainless-steel rod with an internal magnetic reed switch. A stainless-steel float rides on the rod, actuating the reed switch when the water level raises the float to the level preset to indicate a high-high alarm. That level can be set by either adjusting the collars on the rod that are above and below the float, or by loosening the slip-nut fitting above the mounting bushing where it mounts to the top of the tank. This allows the operator to raise or lower the entire rod and float assembly until the appropriate level is determined.

Activating one of these float switches will generate a “high-high” level alarm in the PLC. A high-high alarm anywhere in the WWTP will cause the PLC to shut the entire facility down, including the extraction pumps in the field, then notify the operator, via autodialer, of the condition.

*** **Note** ***

LS-14 and LS-15 are not equipped with a direct ground wire as is normally the case. The probe manufacturer representative recommended that these meters be grounded using a 2-conductor number 18 shielded wire to ground the probes rather than grounding them directly to the control panel.

Fluid levels in the equalization tank (T-1), the OWS tank (T-2), the DNAPL tank (T-3), the LNAPL tank (T-5), and the OWS effluent tank (T-7) can also be determined using the sight glasses located on the end of each tank. These sight glasses—LI-18, LI-19, LI-20, LI-21, and LI-22 respectively—can be used to check the accuracy of the fluid level readouts provided at the PLC screen as determined by the electronic level meters.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of one of the level meters is included as Exhibit 12. Detailed information regarding the level meters and sight glasses are provided in the manufacturer's O&M manuals and cutsheets in Appendix A.17, A.18, and A.19.

2.1.15 Flow Meters

The flow meter used to measure the volume from the backwash tank (T-6); Flow Element/Flow Transmitter (FE/FT)-12) is a Krohne Model 080F magnetic flow meter. This magnetic flow meter has a signal converter that sends a continuous 24-V, DC signal to the system PLC. The signal represents a ratio of maximum flow rate from the riser. The PLC translates this electrical signal into a flow rate value that is displayed on PLC Screen F2 (see Drawing E-6).

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of the flow meter is included as Exhibit 13. Detailed information regarding the flow meter is provided in the manufacturer's O&M manual in Appendix A.20.

2.1.16 Piping

Piping throughout the DNAPL recovery system and WWTP is composed of stainless steel and high-density polyethylene (HDPE) of various sizes. Combination stainless-steel and HDPE transitions are used on HDPE lines to transition to stainless steel pipe fittings. Line types are summarized on Drawing M-4.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. A photograph of the sand filter manifold is included as Exhibit 14. A photograph of the LPAC unit manifold is included as Exhibit 15, and photographs of the backwash tank manifold and the Pump P-12 manifold are included as Exhibits 16 and 17, respectively. Piping product information is provided in the manufacturer's cut sheets in Appendix A.21.

*****WARNING*****

Access to overhead and elevated equipment should always be conducted using approved equipment in accordance with the site health and safety plan. Under no circumstances should any piping or piping manifolds be used as ladders.

2.1.17 Valves

Ball valves, check valves, and gate valves of various sizes are used throughout the DNAPL recovery system and WWTP to control and adjust the flow of liquids and vapors within the system. The size, type of valve, and location within the system are shown on Drawing M-3.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. The stainless-steel ball valves used for liquid piping in the DNAPL recovery vaults are pictured in Exhibit 18. The stainless-steel ball valves used for liquid piping in the WWTP building are pictured in Exhibit 19. The brass ball valves used for the vent piping are pictured in Exhibit 20. A photograph of the brass gate valve used for the freshwater inlet line is included as Exhibit 21.

Information regarding the valves is provided in the manufacturer's cut sheets in Appendix A.22.

2.1.18 Control Panel and Programmable Logic Controller

The system PLC is a GE Fanuc™ computer running a Cimplicity™ control program on a Windows NT™ platform. The PLC is equipped with a 56-kilobytes per second modem, a 3.5-inch disk, a CD-ROM drive, and a printer port. The PLC can be accessed remotely using PC Anywhere™.

The PLC receives an analog (4 to 20 mA) and binary (on or off) electrical signal from the level meters and flow meter. It then translates this information to operate the system pumps, and record and display data from the level meters and flow meter. The control logic and the operation of the DNAPL recovery system and WWTP are described in detail in Section 2.2. The PLC automatically records the electronic data to a Microsoft Excel™ spreadsheet that can be downloaded.

Details regarding the control panel wiring is shown on Drawings E-4 and E-5A. Examples of PLC screens are included on Drawing E-6. PLC input-output wiring diagrams are included in Appendix A.23. Detailed information regarding the control panel and PLC is provided in the manufacturer's O&M manuals in Appendix A.23.

*****WARNING*****

Neither the wiring inside of the control panel nor any of the equipment associated with the DNAPL recovery system or WWTP can be de-energized using the selector switches on the front of the control panel. The only exception is the 4-20 mA analog signal wires running from the PLC panel to the signal transmitters in the ultrasonic and RF probes at the site. Each set of analog signal wires can be isolated by pulling the fuse block, located in the PLC panel box, above each block of wires that need to be isolated. Power must be disconnected in accordance with the lock-out/tag-out procedures described in the site health and safety plan (see Section 6.0) at the power panels (PP1 and PP2), lighting panel (LP1), or the distribution panel (DP) prior to completing any maintenance activities on the equipment described in other subsections of Section 2.1.

2.1.19 Sump Level—Contact Switches

Three level switches (LS-20, -21, and -22) are located in each of the sumps inside of the WWTP. These switches set off an alarm in case of a catastrophic spill. The level switches are Teel Model 4RK04 mechanical piggy-back float switches. The level switches send a 24-V, DC signal to the PLC that shuts down the entire DNAPL recovery system and WWTP and activates the LDS. The LDS is described in Section 2.1.20. The operation of the LDS is described in detail in Section 2.2.

Exact equipment locations and piping connections are shown on Drawings C-16A, C-16B, C-16C, C-16D, and C-17. Information regarding the sump level contact switches is provided in the manufacturer's cut sheets in Appendix A.24.

2.1.20 Leak Detection System

The LDS is a 15-zone system manufactured by Guardian. The LDS receives separate signals from eight different zones along the DNAPL transfer pipeline (see Drawing E-1) and the three WWTP sump switches (4 zones are unused; see Section 2.1.18). A leak detected in any zone triggers an alarm which initiates various actions in the WWTP (in accordance with the PLC programming described in Section 2.2), and automatically dials an emergency number. The autodialer is a Sensaphone Model 1108 mounted inside the control panel.

The autodialer currently calls the Eagle Construction and Environmental Services, Inc., Ft. Worth office, which is attended 24 hours a day, or another predesignated number for the current WWTP operator.

Information regarding the LDS and the autodialer are provided in the manufacturer's O&M manuals in Appendix A.25.

2.1.21 Water Wells

Water well pump 1 is a Crown Model SG-230 submersible vertical turbine. Water well pump 2 is a Flint and Walling Commander Model 4F27S15 submersible vertical turbine. The location of the water wells is shown on Drawings C-14 and C-15. Details regarding the construction of the water wells are shown on Drawings C-27 and E-5B.

A photograph of water well 1 is included as Exhibit 20. A photograph of water well 2 is included as Exhibit 21. Detailed information regarding the water well pumps and motors is provided in the manufacturer's O&M manuals in Appendix A.26.

2.1.22 Pressure Indicators

Local pressure indicators are used throughout the DNAPL recovery system and WWTP to monitor the line pressure and pressure within various process vessels. Two different types of pressure indicators are in use: (1) Solfrunt Model 1991 gauges with a 4-1/2 inch face are used to monitor the pressure in the LPACs, and (2) WIKA gauges with a 2-inch face are used to monitor the pressure at five other locations within the WWTP. Both types of pressure indicators have a range of 0 to 100 pounds psi. None of the pressure indicators are connected to the automatic control system. Operating personnel must constantly monitor the pressure at each point by visual inspection.

The location of the pressure indicators are shown on Drawings M-3, C-16A, C-16B, C-16C, C-16D, and C-17. Detailed information regarding the pressure indicators are presented in the manufacturer's cutsheets in Appendix A.27.

2.1.23 Variable Frequency Drive

A VFD is used to control the operation of pump P-13. The VFD is a General Electric Model AF-300 G11 3-hp drive. VFD01, which operates Pump P-13, provides for a variable pumping rate from the equalization tank (T-1) to the OWS tank (T-2). Because Pump P-15 operates at a much greater system pressure, Pump P-13 must be continually monitored to insure that its operating speed (flow rate) is slightly less than P-15's operating speed. Should P-13 be allowed to pump at a greater rate than P-15, fluid accumulating inside the OWS effluent tank (T-7) will eventually reach the high alarm set point, and very likely be immediately followed by a high-high alarm condition, which will cause the entire facility to shut down.

Electrical details regarding the operation of the VFD is shown on Drawings E-4 and E-5A and E-5B. Detailed information regarding the VFD are provided in the manufacturer's O&M manual in Appendix A.28.

2.1.24 Wastewater Treatment Plant Building Features

The WWTP building is a prefabricated metal building system. Drawings of the WWTP building are included in Appendix C as Drawings C-18A through C-18C. The WWTP building is equipped with a 12-foot roll-up door, two exit doors, a variable position roof vent, and a heating, ventilation, air conditioning (HVAC) system for the control room. Information regarding the building is presented in the manufacturer's warranty and cutsheet data in Appendix A.29.

As a general rule, the roof vent should be left open at all times. Guidelines for instances when the roof vent should be closed will be developed as operating experience is gained. Additionally, the roll-up door should be opened whenever operating personnel are working inside the WWTP building to ensure proper ventilation. However, to ensure proper temperature and moisture control in the WWTP Control Room, the doors to this room should be kept shut at all times, and the HVAC system set to maintain a temperature of 70 °F at all times.

*****WARNING*****

The HVAC must be repaired immediately in the event of any problem. Failure to make timely repairs may cause significant damage to the electronic and computer equipment located inside the WWTP control room.

2.1.25 Vault Sump Pumps

Each vault has a float-switch operated 0.5-hp submersible sump pump installed. The pumps operate on 110 volts alternating current, and plug into a ground fault circuit interrupt outlet box located on the south wall of each vault. The pumps are plumbed into a tee that is connected to the opening for the RF interface probe conduit. Stormwater collecting in the vault will collect in the subgrade sump until the float actuates when the water rises approximately 1 inch above the vault floor. The pumps are designed to be maintenance free, but should be checked periodically to insure satisfactory operation. Should replacement be warranted, the pumps are an off the shelf submersible pump that can be obtained from any home improvement retailer or well stocked hardware store.

2.2 SYSTEM OPERATING INSTRUCTIONS

This section describes the operation of the DNAPL recovery system and WWTP. The general startup sequence for normal operation of the DNAPL recovery system and WWTP is as follows:

- Ensure that valves are in proper position (see Table 2-1).
- Ensure that electrical disconnects in the concrete vaults are in the energized position.
- Ensure that all alarms on the control panel are cleared
- Turn “operation” selectors on the PLC panel to either “DNAPL” or “water.”
- Turn P-1 through P-10 selector switches to “AUTO.”
- Turn P-13, P-14, and P-15 selector switches to “AUTO.”

The DNAPL recovery system and WWTP is designed to run autonomously. However, operating personnel should monitor and observe the operation of the system whenever they are present on site to identify additional operating characteristics that may either (1) improve the effectiveness of the operation of the system or (2) improve the effectiveness of maintenance and inspection activities. These observations should include a visual inspection of the WWTP effluent discharge into the North Ditch every morning when arriving, and every afternoon prior to leaving to ensure that no visible sheen is present.

Detailed operating procedures for each component of the DNAPL recovery system and WWTP are included in the following subsections. These subsections address startup procedures, operating procedures for extraction pump control on DNAPL level, operating procedures for extraction pump control on water level, manual operation, and shutdown procedures.

TABLE 2-1

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
1	Closed	NA	NA	NA	NA	NA	NA
2	Open	NA	NA	NA	NA	NA	NA
3	Closed	NA	NA	NA	NA	NA	NA
4	Open	NA	NA	NA	NA	NA	NA
5	Closed	NA	NA	NA	NA	NA	NA
6	Open	NA	NA	NA	NA	NA	NA
7	Closed	NA	NA	NA	NA	NA	NA
8	Open	NA	NA	NA	NA	NA	NA
9	Closed	NA	NA	NA	NA	NA	NA
10	Open	NA	NA	NA	NA	NA	NA
11	Closed	NA	NA	NA	NA	NA	NA
12	Open	NA	NA	NA	NA	NA	NA
13	Closed	NA	NA	NA	NA	NA	NA
14	Open	NA	NA	NA	NA	NA	NA

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
15	Closed	NA	NA	NA	NA	NA	NA
16	Open	NA	NA	NA	NA	NA	NA
17	Closed	NA	NA	NA	NA	NA	NA
18	Open	NA	NA	NA	NA	NA	NA
19	Closed	NA	NA	NA	NA	NA	NA
20	Open	NA	NA	NA	NA	NA	NA
21	Closed	NA	NA	NA	NA	NA	NA
22	Closed	NA	NA	NA	NA	NA	NA
23	Open	NA	NA	NA	NA	NA	NA
24	Closed	NA	NA	NA	NA	NA	NA
25	Open	NA	NA	NA	NA	NA	NA
26	Open	Closed	Closed	Closed	NA	NA	NA
27	Open	Open	Closed	Closed	NA	NA	NA
28	Open	NA	NA	NA	NA	NA	NA

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
29	Closed	Closed	Closed	Open	NA	NA	NA
30	Open	Open	NA	Closed	NA	Closed	Closed
31	Open	Closed	Open	Closed	NA	Closed	Closed
32	Closed	Closed	Closed	Open	NA	Closed	Closed
33	Open	Open	Open	Open	NA	NA	NA
34	Closed	Closed	Closed	Closed	NA	NA	NA
35	Open	Closed	Closed	Closed	NA	NA	NA
36	Open	NA	NA	NA	NA	Open	Closed
37	Closed	NA	NA	NA	NA	Closed	Open
38	Open	NA	NA	NA	NA	Closed	Closed
39	Open	NA	NA	NA	NA	NA	Closed
40	Closed	NA	NA	NA	NA	Open	NA
41	Open	NA	NA	NA	NA	NA	Open
42	Open	NA	NA	NA	NA	Closed	Closed

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
43	Open	NA	NA	NA	NA	Open	Closed
44	Closed	NA	NA	NA	NA	NA	Open
45	Closed	NA	NA	NA	NA	Closed	Closed
46	Open	NA	NA	NA	NA	NA	Closed
47	Closed	NA	NA	NA	NA	Closed	NA
48	Closed	NA	NA	NA	NA	Open	Open
49	Closed	NA	NA	NA	NA	Closed	Open
50	Open	NA	NA	NA	NA	NA	NA
51	Open	NA	NA	NA	NA	NA	NA
52	Open	NA	NA	NA	NA	NA	NA
53	Closed	NA	NA	NA	NA	NA	NA
54	Closed	NA	NA	NA	NA	NA	NA
55	Closed	NA	NA	NA	NA	NA	NA
56	Closed	NA	NA	NA	NA	NA	NA

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
57	Closed	NA	NA	NA	NA	NA	NA
58	Closed	NA	NA	NA	NA	NA	NA
59	Closed	NA	NA	NA	NA	NA	NA
60	Closed	NA	NA	NA	NA	NA	NA
61	Closed	NA	NA	NA	NA	NA	NA
62	Closed	NA	NA	NA	NA	NA	NA
63	Closed	NA	NA	NA	NA	NA	NA
64	Closed	NA	NA	NA	NA	NA	NA
65	Open	NA	NA	NA	NA	NA	NA
66	Closed	NA	NA	NA	NA	NA	NA
67	Closed	NA	NA	NA	NA	NA	NA
68	Open	NA	NA	NA	NA	NA	NA
69	Closed	NA	NA	NA	NA	NA	NA
70	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
71	Closed	Closed	Closed	Closed	NA	Closed	Closed
72	Closed	Open	Open	Open	NA	Open	Open
73	Closed	Open	Open	Open	NA	Open	Open
74	Closed	Closed	Closed	Closed	NA	Closed	Closed
75	Closed	Open	Open	Open	NA	Open	Open
76	Closed	NA	NA	NA	NA	NA	NA
77	Closed	NA	NA	NA	NA	NA	NA
78	Closed	NA	NA	NA	NA	NA	NA
79	Open	NA	NA	NA	NA	NA	NA
80	Closed	NA	NA	NA	NA	NA	NA
81	Open	NA	NA	NA	NA	NA	NA
82	Closed	NA	NA	NA	Open	NA	NA
83	Open	NA	NA	NA	Open	NA	NA
84	Closed	NA	NA	NA	Closed	NA	NA

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
85	Closed	NA	NA	NA	Closed	NA	NA
86	Closed	NA	NA	NA	Closed	NA	NA
87	Closed	NA	NA	NA	Closed	NA	NA
88	Closed	NA	NA	NA	Closed	NA	NA
89	Not utilized	Not utilized	Not Utilized	Not utilized	Open	Not utilized	Not utilized
90	Closed	NA	NA	NA	Open	NA	NA
91	Closed	NA	NA	NA	Closed	Closed	Closed
92	Closed	NA	NA	NA	NA	NA	NA
93	Open	NA	NA	NA	NA	NA	NA
94	Open	NA	NA	NA	NA	NA	NA
95	Closed	NA	NA	NA	NA	NA	NA
96	Closed	NA	NA	NA	NA	NA	NA
97	Closed	NA	NA	NA	NA	NA	NA
98	Closed	NA	NA	NA	NA	NA	NA

TABLE 2-1 (Continued)

VALVE POSITION KEY TABLE

Valve Number	Position for Startup During Normal Operation[a]	Position for Backwash of Sand Filter 1	Position for Backwash of Sand Filter 2	Position for Backwash of Sand Filter 3	Position for Use of LPAC Units in Parallel	Position for Backwash of LPAC 1 Only	Position for Backwash of LPAC 2 Only
99	Closed	NA	NA	NA	NA	NA	NA
100	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized	Not utilized
101	Closed	NA	NA	NA	NA	NA	NA
102	Closed	NA	NA	NA	NA	NA	NA
103	Closed	NA	NA	NA	NA	NA	NA
104	Closed	NA	NA	NA	NA	NA	NA
105	Closed	NA	NA	NA	NA	NA	NA
106	Closed	NA	NA	NA	NA	NA	NA
107	Closed	NA	NA	NA	NA	NA	NA

Notes:

Normal operation involves the use of both sand filters in parallel and the two liquid-activated carbon units in series.

LPAC Liquid-phase activated carbon
NA Not applicable

*****IMPORTANT*****

Whenever operating personnel leave the facility, they should ensure that all doors to the WWTP building are locked, gates to Water Well No. 1 and the WWTP area are locked, DNAPL recovery system vaults and cleanouts are bolted, and monitoring well covers are bolted. Unnecessary electrical devices (fans, lights) should also be turned off. Because the computer and electrical equipment in the control panel is sensitive to temperature and moisture, operating personnel should also ensure that the HVAC system in the WWTP control room is functional at all times.

2.2.1 Dense Nonaqueous-phase Liquid Recovery System Operation

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the DNAPL recovery system. This system consists of the pumps, level meters, and DNAPL transfer pipeline described in Sections 2.1.1 through 2.1.3.

2.2.1.1 Startup Procedures

The following procedures should be followed when starting any of the DNAPL extraction pumps (Pumps P-1 through P-10) in automatic or manual mode.

Step 1: Open each vault and check for any evidence of leaks from the pumps, piping, or valves.

Step 2: Ensure that all electrical disconnects are in the energized position.

Step 3: Set the valve positions as detailed in Table 2-1. The DNAPL recovery system should be operated with the header valves fully open.

2.2.1.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

This is the most efficient mode in which the DNAPL recovery system can be operated. The submersible DNAPL extraction pumps are each equipped with an HAND-OFF-AUTO (HOA) switch mounted at the WWTP control panel (see Drawing E-4, Nameplates 1 through 10). Normal pump operation in the AUTO position allows each pump to run continuously if DNAPL is present in the riser (see Section 2.2.1.1). The AUTO position enables the level indicator controller (LIC) in each well (LIC-1RF through LIC-10RF), the high-level controller tied to the equalization tank (T-1) (LIC-12 and LIC-13), the DNAPL storage tank level indicator controller (LIC-15), and the LNAPL storage tank level controller (LIC-14) to automatically shutdown the downhole pumps through the PLC. Supplemental liquid levels that affect operation of the downhole pumps include (1) the high-level alarm in the equalization tank (T-1) (liquid deeper than 7.5 feet), or the high-high level alarm, should the high level alarm fail to actuate, at 8 feet of liquid in the equalization tank (T-1), (2) DNAPL is greater than 4 feet deep in the equalization tank (T-1), (3) DNAPL is greater than 3.5 feet deep in the DNAPL tank (T-3), and (4) LNAPL is deeper than 2.5 feet in the LNAPL tank (T-5). Should any of these high-level alarms fail to generate a pump shutdown from the PLC panel, backup is provided in each of the aforementioned tanks by a “high-high” level alarm that will be generated by activating the float switch if liquid is allowed to rise to levels that approach an overflow condition. The set points for the controllers and alarms are defined in PLC screen F6 (see Drawing E-6).

When controlling on DNAPL level, the low-level switch for a particular downhole pump is triggered when the DNAPL-water interface level in that sump decreases to 1 foot from the bottom of the sump, shutting down only the associated downhole pump. After an automatic shutdown event the submersible pumps will automatically resume operation when either (1) the level of DNAPL-water interface has recovered to 2 feet above the bottom of the sump (Level Element [LE]-1RF through LE-10RF), (2) the 4 feet of accumulated DNAPL is removed from the equalization tank (T-1) and the alarm Level Alarm-High (LAH)-12 is manually cleared, (3) accumulated DNAPL in the DNAPL storage tank (T-3) is removed and the alarm LAH-15 is manually cleared, or (4) accumulated LNAPL in the LNAPL storage tank (T-5) is removed and alarm LAH-14 is manually cleared. The set point for each controller (LIC-1RF through LIC-10RF) is indicated on PLC Screen F6 (see Drawing E-6).

2.2.1.3 Operating Procedures—Automatic Control on Water

This is an alternative mode of operation for the DNAPL recovery system. The WWTP operator may choose to use the water-air interface for control (LE-1U through LE-10U) (as opposed to operating on the DNAPL-water interface). In this case, the low-level switch for a particular submersible pump is triggered when the water-air interface level in that sump decreases to a preset level from the bottom of the sump, again shutting down only the associated submersible pump. After an automatic shutdown event during operation when controlling on water level, the downhole pumps will automatically resume normal operation when the level of water-air interface has recovered to a second preset level above the bottom of the sump. These setpoints can be readily altered by a qualified PLC programmer should the need arise. Note: while operating the extraction pumps based on water levels, each riser is inherently less efficient as more water must be treated than would be the case operating on DNAPL levels in each riser, operating history indicates that the longer the extraction pumps remain idle (waiting for DNAPL recharge into the riser sump), the more difficult it is to restart the extraction pumps. For this reason, it is recommended that the field be operated in this mode for as long as is economically feasible.

2.2.1.4 Manual Operating Procedures

The DNAPL recovery system may be operated manually by turning the selector switches for the DNAPL recovery pumps to the HAND position. The system should only be operated in manual mode for maintenance purposes or other special circumstances that may require the operation of a single pump to check the system (for example, following maintenance activities). As with the operation of the DNAPL recovery system in the automatic modes (see Sections 2.2.1.2 and 2.2.1.3), the operator should ensure that the startup procedures described in Section 2.2.1.1 are followed before operating the system manually.

2.2.1.5 Shutdown Procedures

When the DNAPL recovery system is shut down to perform maintenance or other purposes, the following procedures should be followed:

Step 1: Ensure that each ball valve on the 1-inch flowline that connects the pump to the 3-inch delivery line is closed as a backup for the header check valve.

Step 2: Use the sample port valve to slowly drain off any pressure in the line, into an acceptable container, before attempting any adjustments to the lines connected to the pump.

Step 3: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

2.2.2 Equalization System

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the equalization system. This system consists of the equalization tank (T-1), Pump P-13, ultrasonic level meter LE/Level Transmitter (LT)-13, RF probe LE/LT-12, fail-safe float switch LE/Level Float (LF)-13, sight glass Level Indicator (LI)-18, and VFD01. These items are described in detail in Sections 2.1.4, 2.1.13, 2.1.14, and 2.1.21.

2.2.2.1 Startup Procedures

The following procedures should be followed when starting any of the DNAPL extraction pumps (Pumps P-1 through P-10) or the decontamination sump evacuation pump (Pump P-12) to ensure that the equalization tank (T-1) is not overfilled:

Step 1: Ensure that the value position sequence for valves 21, 22, 23, 24, 105, and 106 are in accordance with the startup for normal operation as shown in Table 2-1.

Step 2: Verify that the selector switch for Pumps P-13, P-14, and P-15 are in the AUTO position.

2.2.2.2 Operating Procedures—WWTP in Water Mode

Normal flow to the equalization tank (T-1) will consist of a mixture of DNAPL and ground water delivered by one or all 10 downhole pumps (P-1 through P-10). This will typically occur whether the DNAPL recovery system is operated with automatic control based upon the water level in each riser or the DNAPL level in each riser (see Section 2.2.1.2). The equalization tank (T-1) is also piped to receive flow from the decontamination area sump extraction pump (Pump P-12), and backwash effluent from either the sand filters or LPAC units (see Drawing M-3).

Fluid levels in the equalization tank (T-1) will be gauged automatically by a continuous ultrasonic level meter (LE-13) combined with an RF probe (LE-12). Level information is sent by level transmitters LT-12 and LT-13 to the level indicator controllers LIC-12 and LIC-13 at the PLC. The liquid level is indicated on PLC screens F2 and F5 (see Drawing E-6). The equalization tank (T-1) level indicator controller (LIC-13) will trigger a high-level alarm (LAH-13) when the liquid level in the equalization tank (T-1) reaches 7.5 feet. This alarm condition will illuminate the high-level alarm on PLC Screen F3. High-level alarm LAH-13 will clear when the fluid level in the equalization tank (T-1) drops below 6 feet. Should LAH-13 fail to activate, the fail-safe float switch LE/LF-13 will actuate at a total fluid level in the equalization tank (T-1) of 8 feet, activating Level Alarm-High High (LAHH)-13. This will shut down the entire facility, dial the operator, and notify him that Alert condition No. 4 exists.

When a high level alarm is triggered, the PLC (LIC-13) will initiate the startup sequence of Pump P-13. Pump P-13, will continue to discharge wastewater into the OWS tank (T-2) until LIC-13 triggers a low-level alarm when the liquid in the tank reaches a depth of 4.5 feet. This action will aid in creating an undisturbed settling zone in the lower 4 feet of the equalization tank (T-1) for the DNAPL components in the wastewater stream coming from the field. The PLC will continue to manipulate the operation of Pump P-13 in this manner until 4 feet of DNAPL has accumulated in the equalization tank (T-1).

Pump P-13 is equipped with a VFD-01 and a HOA switch. VFD-01 enables P-13's operating speed to be adjusted from off to full power. Should operating conditions change whereby Pump P-15 is not able to keep up with the flow from Pump P-13 (causing the water level to continue to rise in the OWS effluent tank [T-7]), the potentiometric dial located on the front of the PLC panel can be used to slow P-13's speed down to the point that it is running at or slower than P-15's speed. The best indication that P-13 is running too fast is to witness (on the PLC screen) whether the water level in the OWS effluent tank (T-7) continues to rise with both pumps operating. If a high-high alarm is ever generated by water coming in contact with the float switch in the OWS effluent tank (T-7), the most likely cause would be that P-15 is not keeping up with P-13, indicating the need to slow P-13 down.

2.2.2.3 Operating Procedures—Automatic Control on Water

Operation of the equalization system when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.2.2 for operation of the equalization system when the DNAPL recovery system is controlled on DNAPL.

2.2.2.4 Manual Operating Procedures

The equalization system may be operated manually by turning the selector switch for Pump P-13 to the HAND position. The system should only be operated in manual mode for maintenance purposes or other special circumstances that may require the operation of this pump to check the system (for example, following maintenance activities). As with the operation of the equalization system in the automatic modes (see Sections 2.2.2.2 and 2.2.2.3), the operator should ensure that the startup procedures described in Section 2.2.2.1 are followed before operating the system manually.

The operator must carefully monitor the fluid levels in the equalization tank (T-1) and the OWS effluent tank (T-7) during manual operation to ensure that these tanks are not overfilled or overdrawn. The flow rate or speed of Pump P-13 can be altered while operating in manual mode by turning the PLC panel door-mounted potentiometric dial clockwise to speed it up, or counterclockwise to slow it down; however, care should be taken when doing this as the setting used in manual mode will stay in place when the pumps are put back in AUTO. Operation of Pump P-13 will not be controlled by the PLC while in the manual mode, as this could cause an alarm condition due either to a low liquid level in The equalization tank (T-1), or an overflow condition in the OWS effluent tank (T-7), which will cause hazardous material spills or permanent mechanical damage if the operator is not continuously monitoring the tank levels. The liquid levels in both tanks should only be monitored by utilizing the sight glasses on the eastern end of both tanks, or by opening the inspection hatches.

2.2.2.5 Operating Procedures—WWTP in DNAPL Mode

Over time, DNAPL will accumulate in the equalization tank (T-1) to a depth of 4 feet, triggering the equalization tank (T-1) DNAPL High Level Alarm (LAH-12). When LAH-12 is activated, one of two things will occur prior to the PLC shutting down the system and calling the WWTP operator. If the overall liquid level in the equalization tank (T-1) is less than 6 feet, the PLC will allow the DNAPL recovery pumps P-1 through P-10 to continue to run until the liquid level reaches 6 feet. The PLC will then turn off the DNAPL recovery pumps (P-1 through P-10) and notify the operator that Alert Condition No. 6 exists. If the liquid level is already greater than 6 feet when LAH-12 is activated, the PLC will shut down Pumps P-1 through P-10 at that time and then notify the operator that Alert Condition No. 6 exists.

Alert Condition No. 6, among others, will not allow Pumps P-1 through P-10 to operate until it has been cleared. The procedure to clear Alert Condition No. 6 involves first mobilizing a liquid hazardous waste transporter to the site. When the transporter is at the site and connected to the camlock below valve No. 56 on the transfer box located on the south side of the WWTP building, the operator can either (1) begin transferring first from the DNAPL storage tank (T-3), if the tank is already close to being full, or (2) go directly in DNAPL mode and begin transferring DNAPL from the equalization tank (T-1). To start transferring DNAPL from the equalization tank (T-1) to the DNAPL storage tank (T-3), the operator must first ensure the valve sequence is set up correctly at the equalization tank (T-1). Turn valve 21, 22, 23, 52, 53, 54, and 105 off; and 24 and 106 on. Put Pump P-13 on AUTO. Then at the PLC panel screen, select Screen F-2 (OWS System [see Sheet E-6]). Finally, select the "Enable DNAPL Mode" button located on the upper left hand corner of the screen. Pump P-13 will come on and begin pumping DNAPL into the DNAPL storage tank (T-3) until alarm LAH-15 goes off, shutting down Pump P-13. This will signal that the DNAPL storage tank (T-3) is full. This can be recognized inside the WWTP building by the red light on top of the DNAPL storage tank (T-3) being illuminated, and, if the switch is on, by the audible horn.

At this point, the operator must open valves 55, 56, and 57 (close valve 58) at the DNAPL storage tank (T-3) and inside the transfer box located outside. Upon ensuring that the transporter is ready for transfer, Pump P-17 should be turned on to begin transferring DNAPL from the DNAPL storage tank (T-3) to the transport vessel. As no level metering device is available to monitor the DNAPL in the DNAPL storage tank (T-3) as it is drawn off, the operator must monitor sight glass LI-20 and the pressure gauge downstream of Pump P-17 (watch for a drop in line pressure as the tank becomes empty) to determine when the transfer is complete (Note: the operator must conduct the transfer process from the equalization tank (T-1) to the DNAPL storage tank (T-3) in AUTO as the PLC will <u>not</u> shut down Pump P-13 upon reaching a full tank condition in the DNAPL storage tank (T-3). The only time this should be attempted is if constant oversight of the transfer process is assured, and the operator knows the level of DNAPL inside the equalization tank ([T-1]).

To begin the next transfer from the equalization tank (T-1) to the DNAPL storage tank (T-3), close valve 55, bring up Screen F-2 on the PLC screen, press the highlighted “Reset” button, and then press the “Start” button. This will restart Pump P-13. This procedure will typically be repeated twice, or until a total of 36 inches of liquid (1,783 gallons) has been pumped out of the equalization tank (T-1). Once 36 inches of fluid is transferred, the facility is ready to go back into operation. Close valves 21, 24, 55, 56, 57, and 58, and open valves 23 and 105. Ensure all pumps are in AUTO mode, then select “Water Mode” on Screen F-2. The facility should be back in normal operation.

From an economic standpoint, as DNAPL approaches 3.5 to 4 feet deep in the equalization tank (T-1), the operator may carefully conduct a manual transfer from the equalization tank (T-1) to the DNAPL storage tank (T-3) which will reduce vacuum truck mobilization costs. Care should be used to ensure that DNAPL storage tank (T-3) is not completely full as any DNAPL transferred from the OWS will likely cause an alarm condition. The PLC must be “tricked” to conduct this transfer as DNAPL mode is not selectable with less than 4 feet of DNAPL in the equalization tank (T-1). To accomplish the manual transfer, turn off Pumps P-13 and P-15, then switch the valve setups as if going into DNAPL mode. Once the valves are set, run Pump P-13 in hand until the desired quantity of DNAPL has been transferred to the OWS tank (T-2). After transferring enough DNAPL to safely operate the plant while waiting for the DNAPL level in the equalization tank (T-1) to fill back up, change the valve orientation back to water mode status, put P-13 in AUTO and continue operating the facility until 4 feet of DNAPL collects in the equalization tank (T-1).

2.2.2.6 Shutdown Procedures

When the equalization system is shut down to perform maintenance or other purposes, the following procedures should be followed:

Step 1: Turn off extraction Pumps P1-P10.

Step 2: Turn off backwash Pump P-19.

Step 3: If the equalization tank (T-1) is to be drained, the operator must first pump down the tank to 4.5 feet above the tank floor, then switch the valve sequence, as described in Section 2.2.2.5 for operating the tank in DNAPL mode, to pump the last 3 feet out of the tank. Due to the presence of a solids exclusion baffle in front of the DNAPL draw-off point on the equalization tank (T-1), there will be 1 foot of fluid remaining in the tank after all the fluid is pumped from the tank.

Step 4: Close valves 21, 22, 24, 105, and 106.

Step 5: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

2.2.3 Oil-water Separator System

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the OWS system. This system consists of the OWS tank (T-2), the OWS effluent tank (T-7), Pumps P-14 and P-15, level meters LE/LT-11and LS/LE-16, and sight glasses LI-19 and LI-22. These items are described in detail in Sections 2.1.5, 2.1.13, 2.1.14, and 2.1.21.

2.2.3.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction Pumps (Pumps P-1 through P-10), (2) the decontamination sump extraction pump (Pump P-12), and (3) the equalization tank (T-1) pump (P-13)—in automatic or manual mode—to ensure that the level in the OWS effluent tank (T-7) is not overfilled, and the OWS properly separates water, LNAPL, and DNAPL:

Step 1: Ensure that the valve position sequence is in accordance with Table 2-1.

Step 2: Verify that the selector switch for Pumps P-13, P-14 and P-15 are in the AUTO position.

2.2.3.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

Normal flow to the OWS will consist of a dilute DNAPL/water solution delivered by all 10 downhole pumps (P-1 through P-10). The OWS may also receive supplemental flow from the equalization system (equalization tank [T-]1—see Section 2.2.2) derived from the decontamination area sump extraction system, and backwash effluent from the sand and carbon filters (see Drawing M-3).

Liquid enters the DNAPL recovery chamber in the OWS (T-2) from the equalization tank (T-1). DNAPL components in the wastewater not removed via gravity in the equalization tank (T-1) will be separated in this, the first of three "chambers," in the OWS tank (T-2). The settled DNAPL will be removed from the DNAPL recovery chamber by the DNAPL Removal Pump (P-14). LNAPL constituents overflow a weir from the first chamber into the second chamber of the OWS tank (T-2). Water flows by gravity under the second chamber and over a weir into the third chamber (effluent chamber) of the OWS.

DNAPL Recovery

The DNAPL level in the OWS tank (T-2) is measured by the DNAPL chamber level meter (LE-11). Level meter LE-11 is a continuous RF level meter that is used to monitor the DNAPL-water interface inside the DNAPL recovery chamber. The DNAPL-water interface level information is sent to the PLC by an attached level transmitter (LT-11) to the DNAPL chamber level indicator controller (LIC-11). The level information is displayed on PLC Screens F2 and F4 (see Drawing E-6). DNAPL is transferred to the 1,000-gallon DNAPL storage tank (T-3) from the bottom of the OWS tank (T-2) by the DNAPL Removal Pump (P-14). Pump P-14 is equipped with a HOA switch mounted on the control panel. Normal operation of Pump P-14 in the AUTO mode allows the pump to operate on demand based on an interlock with the OWS level indicator controller (LIC-11). Pump P-14 has a maximum design capacity of 5 gpm.

When the depth of DNAPL in the DNAPL chamber reaches 16 inches above the bottom of the OWS tank (T-2), LIC-11 will start Pump P-14. LIC-11 will also transmit a high-level alarm (LAH-11) displayed on PLC Screen F3. LIC-11 will automatically clear LAH-11 when the DNAPL level in the DNAPL chamber drops to 15.8 inches above the bottom of the OWS tank (T-2).

When the depth of DNAPL in the DNAPL chamber reaches 17.5 inches, LIC-11 will automatically (1) transmit an high-high level alarm (LAHH-11) displayed on PLC Screen F4 and (2) stop the inflow from the equalization tank (T-1) being delivered by Pump P-13. After an automatic shutdown, LIC-11 will automatically restart Pump P-13 when the DNAPL level in the DNAPL chamber drops to a depth of 7.5 inches. After restarting P-13, LIC-11 will also automatically clear LAHH-11.

LIC-11 will also trigger a low-level switch when the level of DNAPL in the DNAPL chamber drops to 1 inch above the tank bottom. No alarm is associated with this switch, but it is displayed on the PLC screen. The switch will trigger the shutdown of the DNAPL removal Pump (P-14). After an automatic shutdown, Pump P-14 will automatically restart normal operation when the liquid level in the DNAPL chamber of the OWS tank (T-2) again rises to a depth of 6 inches.

LNAPL Recovery

LNAPL will separate from the incoming wastewater stream in the DNAPL chamber of the OWS. As the quantity of LNAPL floating on the surface of the water accumulates, it will eventually start spilling over the weir into the LNAPL chamber of the OWS, and then flow by gravity from there to the LNAPL recovery chamber. No level monitoring devices or control devices are incorporated into the LNAPL recovery chamber of the OWS (T-2).

Water Recovery

Water in the DNAPL recovery chamber passes, by gravity, under the LNAPL recovery chamber and over a weir to the effluent chamber, where it flows to the OWS effluent tank (T-7). The OWS effluent tank (T-7) is used as a surge tank for effluent from the OWS tank (T-2), thus providing completely submerged suction on the influent side of P-15. The OWS effluent tank (T-7) includes two level control devices: (1) an ultrasonic probe (LE/LT-16) that constantly gauges the water depth in the tank, and (2) a magnetic reed float switch (LE/LF-16) that prevents overflow mishaps should LE-16 malfunction. As water enters the OWS effluent tank (T-7), the transmitter on the ultrasonic probe (LT-16) provides readouts at both the probe and on the PLC screen (see Drawing E-6). The level indicator controller (LIC-16) generates a high level alarm (LAH-16) when the water in the OWS effluent tank (T-7) reaches a depth of 36 inches. In the AUTO position, LIC-16 will turn on Pump P-15, keeping it on until the level in the tank drops to 7 inches. The failsafe float switch (LE/LF-16) will generate a high-high alarm (LAHH-16), that when activated, will stop Pumps P-1 through P-10, P-13, P-14, and P-15. If the water level in the OWS effluent tank (T-7) is allowed to accumulate to over 40 inches, an electrical fault has likely occurred and will require maintenance. Make sure Pump P-13 is shut down, then put Pump P-15 in manual mode and run in hand mode until the water level drops enough to release the float switch. If the ultrasonic readout matches the level shown in the sight glass, the reset button on the PLC panel screen should be pushed, P-15 returned to AUTO mode, and the plant should return to normal automatic operation. The operator at this point should try and determine the cause of the high-high alarm, as the most likely cause is due to Pump P-13 running faster than P-15, thus causing the overflow condition. This can be corrected by adjusting the speed dial on the front of the PLC panel slightly counter-clockwise until the water level in T-7 remains constant, or drops slightly while both P-13 and P-15 are operating.

2.2.3.3 Operating Procedures—Automatic Control on Water

Operation of the OWS system when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.3.2 for operating the OWS system when the DNAPL recovery system is controlled on DNAPL. However, because of the lower concentration of DNAPL in the feed stream when operating in this mode, Pump P-14 is anticipated to run less.

2.2.3.4 Manual Operating Procedures

The OWS system may be operated manually by turning the selector switch for Pumps P-14 and P-15 to the HAND position. The system should only be operated in manual mode for maintenance purposes or other special circumstances that may require the operation of this pump to check its operation (for example, following maintenance activities). As with all pumps in the facility, permanent mechanical damage will be caused by allowing the pumps to run for prolonged periods without fluid in the impellers. Like the operation of the OWS system in the automatic modes (see Sections 2.2.3.2 and 2.2.3.3), the operator should ensure that the startup procedures described in Section 2.2.3.1 are followed before operating the system manually.

2.2.3.5 Shutdown Procedures

When the OWS system is shut down to perform maintenance or other purposes, the following procedures should be followed:

Step 1: Turn off Pump P-13.

Step 2: If P-15 is in AUTO mode, the PLC will shutdown P-15 when the level of water in Tank-7 reaches 7 inches.

Step 3: Close valves 23, 25, and 50 to isolate the tank from subsequent flow from either direction.

Step 4: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan before conducting any maintenance activities.

Step 5: As floating contaminant constituents will go under the LNAPL chamber weir into the OWS effluent chamber until the fluid level is above the bottom of the LNAPL chamber, the tank should be refilled up to the bottom of the LNAPL chamber in the OWS prior to initiating flow from the equalization tank (T-1). If that is not feasible, the cover over the OWS effluent chamber should be opened to remove those contaminant constituents before they enter the OWS effluent tank (T-7).

2.2.4 Dense Nonaqueous-phase Liquid Storage Tank

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the DNAPL storage tank. This system consists of Tank T-3, Pumps P-14 and P-17, contact probe LE/Level Contact (LC)-15, and float switch LE/LF-15. These items are described in detail in Sections 2.1.7, 2.1.13, and 2.1.14.

2.2.4.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction Pumps (Pumps P-1 through P-10), (2) the decontamination sump extraction pump (Pump P-12), (3) the equalization tank (T-1) pump (P-13), and (4) the OWS system—in automatic or manual mode—to ensure that Tank T-3 is not overfilled:

Step 1: Ensure the valve position sequence is in accordance with Table 2-1.

Step 2: Verify that the selector switch for Pump P-14 is in the AUTO position.

2.2.4.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

The DNAPL storage tank (T-3) is used to store DNAPL removed from the equalization tank (T-1) and from the influent stream in the OWS (T-2) prior to off-site disposal. The 1,000-gallon DNAPL storage tank (T-3) will receive DNAPL from the equalization tank (T-1) at a flow rate of about 40 gpm using Pump P-13, and from the OWS DNAPL recovery chamber at a flow rate of 5 gpm using the DNAPL removal Pump (P-14). Pump P-14 is equipped with an HOA switch mounted locally. Normal operation of Pump P-14 in the AUTO position enables it to cycle on an as-needed basis, depending on the level of DNAPL in the DNAPL chamber of the OWS. This operation is controlled by the DNAPL chamber level indicator controller (LIC-11). DNAPL from the equalization tank (T-1) can be transferred either manually or automatically (see Section 2.2.2.5).

The only way to gauge the depth of DNAPL in the DNAPL storage tank (T-3) is by using sight glass LI-20. However, when the DNAPL reaches a depth of 3.5 feet, it will come into contact with probe LE/LC-15. Making contact, the PLC will generate alarm LAH-15, which shuts down pumps P-1 through P-10, P-13, P-14, and P-15. Once the alarm is activated, both an audible and a visual alarm will go off inside the WWTP; however, the audible alarm can be turned off at the tank should it not be needed or if the operator is away from the site. A backup or fail-safe float switch is also attached to the tank in the unlikely event that LAH-15 fails to activate and flow continues into the tank. LE/LF-15, when activated, causes the PLC to generate alarm LAHH-15. This alarm conducts the same shutdown sequence as LAH-15 and is thus only intended as a backup. Both alarms will cause the autodialer to call the operator and identify a plant shutdown due to Alert Condition No. 1 (LAH-15) or Alert Condition No. 7 (LAHH-15); both require the operator’s immediate attention.

To clear either alarm, the operator must first transfer the DNAPL from the DNAPL storage tank (T-3) to a suitable liquid hazardous waste carrier. Once the level is less than 3 feet in the DNAPL storage tank (T-3), the operator must clear the alarm by “Acknowledging” and then “Resetting” the appropriate alarm on the PLC alarm screen display. Once the offending alarms are cleared, the facility will return to normal operation.

2.2.4.3 Operating Procedures—Automatic Control on Water

Operation of the DNAPL storage tank when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.4.2 for operating the DNAPL storage tank when the DNAPL recovery system is controlled on DNAPL.

2.2.4.4 Manual Operating Procedures

The DNAPL storage tank can be filled manually by turning the selector switch for Pump P-14 to the HAND position. Filling the DNAPL storage tank in manual mode should only be conducted for maintenance purposes or other special circumstances that may require the operation of this pump to check its operation (for example, following maintenance activities). A full condition in the tank will only be indicated by the red alarm light and audible enunciator located on the top of the DNAPL storage tank (T-3). The PLC will not shut down transfer pumps operating in MANUAL mode. As with the operation of the DNAPL storage tank in the automatic modes (see Sections 2.2.4.2 and 2.2.4.3), the operator should ensure that the startup procedures described in Section 2.2.4.1 are followed before operating the system manually.

Pump P-17 can only be operated manually. This pump is started and stopped using a local switch at the pump. The operator must carefully monitor the fluid levels in Tank T-3 and in the receiving tank during manual operation to ensure that (1) Pump P-17 is not operated dry and (2) the receiving tank is not overfilled. This should include visual inspection of the liquid level in the sight glass (LI-20), and observation of the line pressure on the downstream side of Pump P-17.

2.2.4.5 Shutdown Procedures

When the DNAPL storage tank is shut down to perform maintenance or other purposes, the following procedures should be followed:

Step 1: Turn off Pump P-14.

Step 2: Close valves 24, 51, 52, 55, and 56 to isolate the tank from subsequent flow from either direction.

Step 3: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

2.2.5 Light Nonaqueous-phase Liquids Storage Tank

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the LNAPL storage tank. This system consists of Tank T-5, Pump P-16, contact probe LE/LC-14, and float switch LE/LF-14. These items are described in detail in Sections 2.1.8, 2.1.13, and 2.1.14.

2.2.5.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction pumps (Pumps P-1 through P-10), (2) the decontamination sump extraction pump (Pump P-12), (3) the equalization tank (T-1) Pump (P-13), and (4) the OWS system—in automatic or manual mode—to ensure that Tank T-5 is not overfilled:

Step 1: Ensure that the valve position sequence is in accordance with Table 2-1.

2.2.5.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

The LNAPL storage tank (T-5) is used to store LNAPL removed from the influent stream in the OWS (T-2) prior to off-site disposal. The 250-gallon LNAPL storage tank (T-5) will receive product from the OWS LNAPL chamber by gravity at a maximum flow rate of less than 1 gpm. LNAPL is not anticipated to be a significant component of the influent. Tank T-5 is equipped with both a tank-level sight glass (LI-19), to visually inspect the amount of product in the tank, a contact probe (LE/LC-14), and a float switch (LE/LF-14).

The contact probe LE/LC-14 signals the PLC that the tank is full when LNAPL comes in contact with the probe at a depth of 2.5 feet. When this happens, a high level alarm (LAH-14) is generated, which causes Pumps P-1 through P-10, P-13, P-14, and P-15 to shut down. An audible horn alarm and red warning light are also activated; however, the horn can be deactivated by turning off the switch located on the wall below the horn. The autodialer will then call the operator and notify him that Alert Condition No. 2 exists.

In the event that LE/LC-14 fails to activate and LNAPL (or other liquid due to OWS malfunction) continues to accumulate in the LNAPL storage tank (T-5), a backup float switch (LE/LF-14) is also attached to the tank. When the float activates, the PLC generates a high-high level alarm (LAHH-14), which repeats the same pump shut down sequence and autodialer notification. When the autodialer notifies the operator of Alert Condition No. 7, it is absolutely imperative that the operator return to the facility to ensure tht an overflow condition has not occurred, or a condition exists that might lead to one if prompt attention to the problem that led to the alarm is not provided.

The WWTP operator must empty the LNAPL storage tank (T-5) into the appropriate storage device for off-site treatment using the LNAPL outlet Pump (P-16). Pump P-16 can only be operated manually with a local HAND-OFF switch. Once the LNAPL level in Tank T-5 is below the high-level alarm set point, the WWTP operator must manually clear LAH-14 (and LAHH-14 if activated) before restarting the WWTP DNAPL recovery system and WWTP from the control panel.

2.2.5.3 Operating Procedures—Automatic Control on Water

Operation of the LNAPL storage tank when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.5.2 for operating the LNAPL storage tank when the DNAPL recovery system is controlled on DNAPL.

2.2.5.4 Manual Operating Procedures

The LNAPL storage tank can only be filled by gravity flow. Pump P-16 can only be operated manually. This pump is started and stopped using a local switch at the pump. The operator must carefully monitor the fluid levels in Tanks T-5 and in the receiving tank during manual operation to ensure that (1) Pump P-16 is not operated dry and (2) the receiving vessel is not overfilled. This should include visual inspection of the liquid level in the sight glass (LI-21) and the pressure gauge located downstream of the pump.

2.2.5.5 Shutdown Procedures

When the DNAPL storage tank is shut down to perform maintenance or for other purposes, the following procedures should be followed:

Step 1: Close valves 50 and 59 to isolate the tank from subsequent flow from either direction.

Step 2: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

2.2.6 Sand Filters

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the sand filter system. This system consists of a series of three sand filters, associated piping and a valve manifold to regulate the flow through the filters in various configurations, and a pressure indicator. These items are described in detail in Sections 2.1.9 and 2.1.20.

2.2.6.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction pumps (Pumps P-1 through P-10), (2) the decontamination sump extraction pump (Pump P-12), (3) the equalization tank (T-1) pump (P-13), and (4) the OWS system—in automatic or manual mode—to ensure that sand filters will operate effectively:

Step 1: Ensure that the valve position sequence is in accordance with Table 2-1.

2.2.6.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

The sand filter system is a passive system that is operated in different configurations by opening and closing a series of valves on the sand filter piping manifold. A variety of valve configurations are presented in Table 2-1. The operating pressure of the sand filter manifold should be periodically monitored when P-15 is operating. Maintenance activities should be initiated in accordance with the procedures described in Section 3.1.9 when the line pressure becomes greater than 10 psi.

2.2.6.3 Operating Procedures—Automatic Control on Water

As noted in Section 2.2.6.2, the sand filter system is a passive system that is operated in different configurations by opening and closing a series of valves on the sand filter piping manifold. Operation of the sand filter system when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.6.2 for operating the sand filter system when the DNAPL recovery system is controlled on DNAPL. However, because more water will be generated when operating the recovery system based on the water levels in each riser, the flow rate of water through the sand filter system will be higher when operating in this mode.

2.2.6.4 Manual Operating Procedures

As noted in Section 2.2.6.2, the sand filter system is a passive system that is operated in different configurations by opening and closing a series of valves on the sand filter piping manifold. No difference exists between operating the sand filter system in manual mode and the automatic modes described in Section 2.2.6.2 and 2.2.6.3. Manual operations involving backwash activities of the sand filters are described in Section 3.1.8.

2.2.6.5 Shutdown Procedures

When a sand filter is shut down to perform maintenance or other purposes, the following procedures should be followed:

Step 1: Turn off Pump P-15.

Step 2: Close valves 26, 35, and 69.

Step 3: Slowly open valves 95, 96, and 97 to bleed off any residual pressure and drain the water from the vessels. Any air pressure on the manifold or in each vessel can be relieved by slowly opening valves 101, 102, and 103 after the drain valves have been open for a few minutes. Close the inlet and outlet valves to each sand filter that is being shut down.

Step 4: Reverse the shutdown process to bring the other sand filters back on-line.

Step 5: Follow lock-out/tag out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

If the sand filter system is to be shut down for more than 2 weeks, isolate the sand filter(s) to be shut down by closing the inlet valve (see Table 2-1), then slowly open the corresponding drain valve located on the bottom of that vessel. Relieve air pressure by slowly opening the corresponding air relief valve located at the top of each vessel.

2.2.7 Liquid-phase Activated Carbon

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the LPAC system. This system consists of two LPAC units, an associated piping and valve manifold to regulate the flow through the filters in various configurations, and three pressure indicators. These items are described in detail in Sections 2.1.10 and 2.1.20.

2.2.7.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction pumps (Pumps P-1 through P-10), (2) the decontamination sump extraction pump (Pump P-12), (3) the equalization tank (T-1) Pump (P-13), and (4) the OWS system—in automatic or manual mode—to ensure that LPAC units will operate effectively:

Step 1: Ensure the valve position sequence for all valves is in accordance with Table 2-1.

2.2.7.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

The LPAC system is a passive system that is operated in different configurations by opening and closing a series of valves on the LPAC piping manifold. A variety of valve configurations are presented in Table 2-1. The operating pressure of the LPAC units and the piping manifold should be periodically monitored when

P-15 is operating. Maintenance activities should be initiated in accordance with the procedures described in Section 3.1.6 when the line pressure becomes greater than 10 psi.

2.2.7.3 Operating Procedures—Automatic Control on Water

As noted in Section 2.2.7.2, the LPAC system is a passive system that is operated in different configurations by opening and closing a series of valves on the LPAC piping manifold. Operation of the LPAC system when the DNAPL recovery system is controlled on water does not vary from the procedures described in Section 2.2.7.2 for operating the sand filter system when the DNAPL recovery system is controlled on DNAPL. The flow rate of water through the LPAC system will be higher when operating in the water level mode.

2.2.7.4 Manual Operating Procedures

As noted in Section 2.2.7.2, the LPAC system is a passive system that is operated in different configurations by opening and closing a series of valves on the LPAC piping manifold. No difference between exists operation of the LPAC system in manual mode and the automatic modes described in Sections 2.2.7.2 and 2.2.7.3.

2.2.7.5 Shutdown Procedures

When an LPAC unit is shut down to perform maintenance or other purposes, and flow is to continue through the other unit, the following procedures should be followed:

Step 1: Turn off Pump P-15.

Step 2: To isolate LPAC unit C-1A, close valves 36 and 45. Valves, 41, 44, and 49 should already be closed for normal operation of C-1B.

Step 3: The water and pressure in the LPAC can be drained by slowly opening valve 86. To isolate C-1B, close valves 37 and 46. Valves 40, 43, 48, and 49 should already be closed for normal operation of LPAC unit C-1A. The water and line pressure in LPAC unit C-1B can be relieved by slowly opening valve 88.

Step 4: Reverse the shutdown process to bring the other LPAC unit back on-line.

Step 5: Follow lock-out/tag-out procedures and confined space entry procedures, in accordance with the site health and safety plan, before conducting any maintenance activities.

If an LPAC unit is to be shut down for more than 2 weeks, isolate the vessel by closing the valves listed in Table 2-1 that place the opposite LPAC unit in service. Bleed off any residual pressure, open the manway, and pump off any liquid to the equalization tank (T-1).

2.2.8 Vapor-phase Activated Carbon Units

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the vapor-phase activated carbon (VPAC) system. This system consists of two VPAC units and an associated piping and valve network to regulate the flow through the units. These items are described in detail in Sections 2.1.12.

2.2.8.1 Startup Procedures

The following procedures should be followed when starting (1) the DNAPL extraction Pumps (Pumps P-1 through P-10), (2) the decontamination sump Pump (Pump P-12), (3) the equalization tank (T-1) Pump (P-13), and (4) the OWS system—in automatic or manual mode—to ensure that VPAC units will operate effectively:

Step 1: Ensure that the valve position sequence is in accordance with Table 2-1.

These valves should be tagged "Do not operate" to ensure that the valves are not inadvertently closed during operation of the DNAPL recovery system and WWTP.

2.2.8.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

No operating procedures are associated with the operation of the VPAC.

2.2.8.3 Operating Procedures—Automatic Control on Water

No operating procedures are associated with the operation of the VPAC.

2.2.8.4 Manual Operating Procedures

No operating procedures are associated with the operation of the VPAC.

2.2.8.5 Shutdown Procedures

When a VPAC unit is shut down to perform maintenance or replacement, the following procedures should be followed:

Step 1: Turn off all pumps associated with the DNAPL recovery system and WWTP.

Step 2: Close valves 65 and 68.

Step 3: Follow procedures in accordance with the site health and safety plan before conducting any maintenance activities.

If a VPAC unit is to be shut down for more than 2 weeks, isolate the vessel by closing the valves listed in Table 2-1.

2.2.9 Water Wells

The following subsections address startup procedures, automatic operating procedures, manual operating procedures, and shutdown procedures for the water well system. This system consists of two water wells; associated electrical, piping, and valve network; and pressure tanks to regulate the flow from the units. These items are described in detail in Sections 2.1.21. The thermal plant well may be used in the future for irrigation purposes; however, it is not associated with the DNAPL recovery system or the WWTP and does not have a power feed. Therefore, it is not described further in this section. The following subsections describe the operation of the WWTP well in association with the operation of the WWTP.

2.2.9.1 Startup Procedures

The WWTP well starts and stops automatically, depending on the pressure in the pressure tank in the well house. The WWTP is turned on by (1) energizing the breaker on PP1 and (2) energizing the electrical disconnect in the well house. No special activities are associated with the startup of the WWTP well. A gate valve (101) located on the freshwater inlet line (see Drawing M-3) is normally closed and is only opened to assist in the operation of the WWTP, as described in Section 2.2.9.2.

2.2.9.2 Operating Procedures—Automatic Control on Dense Nonaqueous-phase Liquid

Fresh water from the WWTP well may be added to the WWTP system through a 2-inch line that ties into the effluent piping for Pump P-15.

2.2.9.3 Operating Procedures—Automatic Control on Water

Fresh water from the WWTP well is not anticipated to be used during operation of the WWTP system when the DNAPL recovery system is controlled on water.

2.2.9.4 Manual Operating Procedures

As noted in Section 2.2.9.1, the WWTP water well pump is cycled based on the water level in the pressure tanks.

2.2.9.5 Shutdown Procedures

When the WWTP water well is shut down to perform maintenance or replacement, the following procedures should be followed:

Step 1: De-energize the electrical disconnect in the WWTP water well.

Step 2: Turn the breaker in PP1 to the off position.

3.0 DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM AND WASTEWATER TREATMENT PLANT MAINTENANCE

This section describes all types of maintenance activities associated with the DNAPL recovery system and WWTP, including lubrication schedules, routine maintenance activities, and long-term shutdown procedures.

Maintenance should be carried out in a manner that prevents emergencies or unscheduled shutdowns. Three factors that must be considered in the completion of maintenance activities are design, construction, and operation. Drawings showing each unit, piping, valves, and electrical schematics shall be readily available on site for easy reference. All maintenance requires considerable skill, which can only be acquired by experience, study, and practice. Maintenance personnel requirements are described in Section 5.0. The maintenance program for the MCW DNAPL recovery system and WWTP shall observe the following guidelines:

- Follow the systematic plan for execution of scheduled maintenance procedures.
- Follow the routine schedule for inspection.
- Complete and retain operating data and maintenance records for each piece of equipment—with emphasis on unusual incidents and faulty operating conditions (recordkeeping and standard recording forms are described in detail in Section 4.0).
- Observe established safety measures.

The following subsections present maintenance activities for each piece of equipment in the system. Each piece of equipment has been assigned an identification number. For each piece of equipment, a list of all items recommended by the manufacturer requiring routine maintenance or inspection has been prepared. The list also identifies the frequency with which inspection and maintenance should be performed. Recordkeeping and standard recording forms are described in detail in Section 4.0. Special instructions recommended by the manufacturer for preventive maintenance such as type of lubricant, oils, special tools, and critical components that may require stockpiling are not included in the text; instead, this information is included in the manufacturer's O&M manuals included in Appendix A. Appendix A contains manufacturer's catalogues, O&M manuals, parts lists, shop drawings, cut sheets, and other information on the equipment. A complete set of record drawings is also included in Appendix A for maintenance and troubleshooting.

3.1 ROUTINE MAINTENANCE AND INSPECTION

System maintenance and inspection activities are categorized as (1) routine, (2) special, (3) emergency, and (4) winter. Routine maintenance and inspection activities are those that are regularly performed and required to keep equipment and systems in satisfactory continuous operation.

Lubrication is probably the most important function of a routine maintenance program and if possible, should be the responsibility of one person. Economy dictates that the best quality of oils and grease obtainable should be used. It is very important to follow the procedures outlined below and the manufacturer's recommendations presented in Appendix A. These procedures should be studied carefully, followed, and documented accordingly. All extruded grease should be collected and properly disposed. It is a good practice to eliminate as many different types of lubricants and consolidate as much as possible. The lubricant supplier should be contacted to have their specialist visit the site and go over the manufacturer's O&M manuals and determine which lubricants best suit the conditions. For example, the manufacturer may recommend that a certain type of oil be changed every 1,000 hours of operation. There may not be another use for this type of oil, necessitating that it be stocked only for the one piece of equipment. Instead, the lubricant supplier may have another type of oil that will function just as well but only for 750 hours. If this type of oil can be used on other pieces of equipment, it may be more economical to stock this type and change oil more frequently. This will also help to eliminate the chance of using the incorrect lubricant because of the reduced selection available. Lubrication procedures for each piece of equipment associated with the DNAPL recovery system and WWTP are described below. Lubrication activity recording forms are included in Section 4.0.

Special maintenance activities are those that are not regularly performed, but which can be scheduled on a nonemergency basis. Emergency maintenance activities are those required to be performed to correct a situation where damage has already occurred or to prevent a potential damaging situation. Winter maintenance activities are those required to protect the system from damage during periods of freezing temperatures. The vaults for the extraction well pumps, the effluent pump station, and any aboveground piping should be inspected at least twice during the winter. Snow or heavy ice accumulation should be removed, and valve operation should be checked. Ensure that the heater is working in WWTP building and that flow is entering the equalization tank (T-1).

The following subsections summarize these maintenance activities and schedules for each of the items described in Section 2.1. Detailed maintenance information is included in the O&M manuals included in Appendix A.

Whenever operating personnel are conducting maintenance activities associated with an alarm condition, the following procedures should be followed:

Step 1: Notify management personnel (see Section 5.0) so that they can independently interface with the WWTP control system remotely to determine the cause of the problem.

Step 2: Arrive on property and implement appropriate lock-out/tag-out procedures for the equipment requiring maintenance and any associated equipment, in accordance with the site health and safety plan.

Step 3: Determine the type of repairs that are required, and seek and receive approval from management personnel before starting any activities.

Step 4: Complete the necessary repairs and verify that repairs are complete by inspecting the information displayed on the PLC screens.

Step 5: Visually inspect the rest of the DNAPL recovery system and WWTP in order to identify any additional irregularities of equipment in need of repair.

Step 6: Reenergize the equipment in accordance with the appropriate lockout/tagout procedures and move all valves to the correct positions.

Step 7: Start the DNAPL recovery system and WWTP in manual mode until satisfied that everything is running correctly before switching to automatic control.

Step 8: Document all activities so that an accurate record of all repairs is in place.

Operating personnel should follow lock-out/tag-out procedures, and confined space entry procedures in accordance with the site health and safety plan, before conducting any maintenance activities.

3.1.1 Routine Maintenance and Inspection for the Extraction Pumps (P-1 through P-10)

Routine maintenance for each unit should consist of weekly adjustment and lubrication of the packing, along with monthly lubrication of the bearings. Greasing the packing frequently with limited quantities of grease is the best practice. Inject grease, selected from the following list, through the zerk fitting that leads to the lantern ring, as shown in the Manufacturer's O&M Manual in Appendix A. Adjustment of the packing is accomplished by tightening the packing gland adjusting nuts. At any point of operation where leaking of the packing is suspected, even tightening of the nuts will keep the packing properly compressed and sealed (see Appendix A for location of the gland adjusting nuts).

RECOMMENDED LUBRICANTS

Dow Corning	DC33
Keystone Lubricating	Keystone #89
Texaco Regal	AFB2
Shell Oil Company	Cyprina #3
American Oil Company	Supermill Grease #A72832
Mobil	EP1
Shell Oil Company	Alvania #2
Gulf	Gulfcrown EP1

Monthly lubrication of the bearings is required to ensure continued operation. Inject grease into the zerk fitting until clear grease is extruded from the pressure relief plug in the drive head casting (see Appendix A). Collect and dispose of all extruded grease.

An inspection of the pumps should be conducted and recorded on the forms included in Section 4.0 at least weekly. On a semiannual basis, this inspection should include the measurement of the stainless-steel risers to check the amount of sand or sediment accumulating in the riser sump. Should the riser become clogged with sand or sediment that might block the flow of DNAPL, the riser should be back flushed and purged.

Information regarding the field repair of the pumps is provided in the manufacturer's O&M manuals in Appendix A.

3.1.2 Routine Maintenance and Inspection for the Dense Nonaqueous-phase Liquid Recovery System Riser Level Meters

No routine maintenance of the DNAPL recovery system riser level meters is required.

An inspection of the level meters should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding the field servicing of the level meters is provided in the manufacturer's O&M manuals in Appendix A.

3.1.3 Routine Maintenance and Inspection for the Dense Nonaqueous-phase Liquid Transfer Pipeline

Should a substantial reduction in the flow volume be suspected, hydraulic "pigging" of the line is recommended. Upstream connection to the line can be accomplished in Vault 5 (at Risers 9 and 10). Downstream connection to the 3-inch line can be accomplished at the flow meter by pass header located outside of the WWTP building on the eastern wall. Likely indicators that such a procedure is warranted include excessive surging of multiple pumps and long extraction pump cycle times, with little or no drop in DNAPL levels in the risers, accompanied by high line pressure when the pumps are running.

3.1.4 Routine Maintenance and Inspection for the Equalization Tank T-1

Monitoring for excessive solids buildup should be performed in the equalization tank (T-1). A one-foot high baffle plate is in place over the DNAPL extraction flange. This plate allows for sediment-free extraction of DNAPL from the tank while in DNAPL mode. Should settled solids accumulate to a depth greater than 1 foot, DNAPL storage volume is reduced, and the operator runs the risk of clogging the pipe or pump internals when transferring DNAPL from the equalization tank (T-1) to the DNAPL storage tank (T-3). Annual gauging of the solids buildup should be scheduled. A suitable, lightweight rod or pole of non-plastic material at least 10 feet long will be needed. Remove the bolts on the inspection hatch on top of the equalization tank (T-1) and remove the lid. Holding the rod against one corner of the hatch, slowly lower the pole, keeping a vertical alignment until slight resistance is felt at the bottom of the tank. Mark the pole where the ceiling of the tank meets the pole, then carefully remove the pole, wiping it down with suitable material as it is pulled out. Measure from the bottom of the pole to the mark made where the ceiling met the pole. If that distance is less than 8 feet, the tank needs to be cleaned out. Pump as much water (in Water Mode) from the equalization tank (T-1) as is needed to drop the overall level to 5 feet, and then set the valves in accordance with Section 2.2.2.5 for going into DNAPL mode, then pump the remaining fluid, into Tank T-3, until 1 foot (or slightly more depending on the quantity of solids) of fluid remains. At this point, a vacuum truck or other suitable device can gain access to the tank through the inspection hatch and remove solids from the tank. It is likely that the eastern regions inside the tank will be difficult to reach, so if a complete cleanout is required, the best method to gain access will be to extract solids in the vicinity of the manway located on the western wall of the equalization tank (T-1). Once the solids are cleared from the passageway, the manway hatch can be safely removed without risk of spill. Suitable confined space precautions including explosive gas monitoring and oxygen levels, and appropriate lock out/tag out procedures must be strictly adhered to prior to entry into the tank.

3.1.5 Routine Maintenance and Inspection for the Oil-water Separator System

Should sludge buildup in any of the OWS tanks become such that the normal operation of the tank is limited, cleanout of that tank is warranted. Proper procedures for cleanout of the OWS are described in the manufacturer's O&M manual in Appendix A.

An inspection of the OWS should be conducted and recorded on the forms included in Section 4.0 at least weekly. On an annual basis, this inspection should include testing for structural integrity.

Information regarding the field repair of the OWS is provided in the manufacturer's O&M manuals in Appendix A.

3.1.6 Routine Maintenance and Inspection for the Dense Nonaqueous-phase Liquid Storage Tank

Should sludge buildup in Tank T-3 become such that the normal operation of the tank is limited, cleanout of that tank is warranted. Proper procedures for cleanout of T-3 are described in the manufacturer's O&M manual in Appendix A.

An inspection of the T-3 should be conducted and recorded on the forms included in Section 4.0 at least weekly. On an annual basis, this inspection should include testing for structural integrity.

Information regarding the field repair of T-3 is provided in the manufacturer's O&M manuals in Appendix A.

3.1.7 Routine Maintenance and Inspection for the Light Nonaqueous-phase Liquids Storage Tank

Should sludge buildup in Tank T-5 become such that the normal operation of the tank is limited, cleanout of that tank is warranted. Proper procedures for cleanout of T-5 are described in the manufacturer's O&M manual in Appendix A.

An inspection of T-5 should be conducted and recorded on the forms included in Section 4.0 at least weekly. On an annual basis, this inspection should include testing for structural integrity.

Information regarding the field repair of T-5 is provided in the manufacturer's O&M manuals in Appendix A.

3.1.8 Routine Maintenance and Inspection for the Sand Filters

An inspection of the sand filters should be conducted and recorded on the forms included in Section 4.0 at least weekly. Maintenance and inspection of the sand filters is related to the WWTP effluent quality monitoring program described in Section 3.4. If rising levels of total suspended solids, subsequent to backwashing procedures, are detected in the WWTP effluent, the sand in the sand filters may need to be replaced. As data is collected from the operation of the DNAPL recovery system and WWTP, more specific procedures for monitoring the effectiveness of the sand filters should be added to this O&M manual.

Information regarding the field repair of the sand filters is provided in the manufacturer's O&M manuals in Appendix A.

When the pressure drop across a sand filter increases to 10 psi above the recorded clean pressure drop value, the filter should be backwashed. Backwashing should be completed as follows:

Step 1: Check the system for leaks.

Step 2: Record prebackwash pressure drop.

Step 3: Turn off all pumps at the main control panel.

Step 4: Reposition valves for entire system in accordance with Table 2-1.

Step 5: Turn on Pump P-19 for 10 minutes.

Step 6: Turn off Pump P-19.

Step 7: Reposition valves for normal operation in accordance with Table 2-1.

Step 8: Restart the system in accordance with the procedures outlined in Section 2.2.

Step 9: Record postbackwash pressure drop for the sand filter that was cleaned.

If the postbackwash pressure drop is not below 10 psi, the procedure should be repeated. If the pressure drop does not drop below 10 psi after two backwash cycles, conduct proper procedures for isolating and draining the vessel, open the inspection hatch and inspect for biological (algae) growth on the sand. Should biological growth be determined to be the cause of excessive pressure on suspended solids, conduct suitable oxidation procedures in accordance with the manufacturer's recommendations. Should this not prove to be an effective solution to the problem, the sand media in that filter may need to be replaced (see Section 3.1.9.1).

3.1.8.1 Media Removal

The following procedures should be followed for media removal:

1. Isolate the filter to be changed by closing the two 3-inch valves connected to that filter.
2. Bleed off any tank pressure by slowing opening the drain valve followed by slowly opening the air relief valve at the top of the tank.
3. Remove the manway.
4. Vacuum out the media with either a vac-truck or drum vacuum.

3.1.8.2 Media Installation and Startup

The following procedures must be followed after every change-out of media in the sand filters.

1. Remove the manway cover and fill each vessel about one-third full with clean water.

2. Add media in the following order:

   a. 14 ft^3 of gravel (4.77-millimeter [mm]/0.187 inch/#4 mesh)
   b. 27 ft^3 of sand (9.85 mm/0.0331 inches/#20 mesh)

3. When the media is in the vessel, close and secure the manway, open the air relief valve, and completely fill the vessel with water. When the water exits the relief valve, close it.

4. Check the system for leaks, then backwash the vessel for 10 minutes by (a) first closing all ball valves on either side of the other two sand filters; (b) open the two ball valves in front and in back of the sand filter that just had the media replaced; (c) open the ball valves in front and behind Pump P-19; (d) close the ball valve on the line leading to the carbon filters; (e) turn on Pump P-19 for 10 minutes.

5. The filter is now ready to be placed in service.

When the filter is put on line, record the clean media pressure drop by reading the pressure off of the gauge located above valve 33 on the sand filter manifold. After 1 hour of operation, reopen the air relief valve on top of the tank until all air is purged from the system.

3.1.9 Routine Maintenance and Inspection for the Liquid-phase Activated Carbon Units

An inspection of the LPAC units should be conducted and recorded on the forms included in Section 4.0 at least weekly. Maintenance and inspection of the LPAC units is related to the WWTP effluent quality monitoring program described in Section 3.4. If rising levels of volatile organic compounds (VOC) are detected in the WWTP effluent, the activated carbon in the LPAC units may need to be replaced. As data is collected from the operation of the DNAPL recovery system and WWTP, more specific procedures for monitoring the effectiveness of the LPAC units should be added to this O&M manual.

Information regarding the field repair of the LPAC units is provided in the manufacturer's O&M manuals in Appendix A.

3.1.9.1 Liquid-phase Activated Carbon Vessel Preparation

To remove spent carbon, the easiest method is to connect a vacuum source to either valve 85 or 87 depending on which vessel is being changed out. Isolate the LPACs by closing valves 35, 45, and 46 and then open the respective adsorbent drain valve and allow the system pressure to drain the carbon slurry out of the tank. Supplemental water may be needed to completely clean out the vessel.

Prior to adding fresh carbon to an empty LPAC vessel, the vessel must be filled with uncontaminated water so that there is at least 2 feet of water above the under drain. Add 2,000 pounds of GAC. Isolate the LPAC unit from the treatment system piping by closing the appropriate valves in accordance with Table 2-1, depending on which vessel is to be backwashed, so that the backwash water does not flow into the adjacent vessel.

Backwash with uncontaminated water for 30 minutes at a rate of 175 to 215 gpm using Pump P-19. Shutdown P-19 and close the valve on the line coming from P-19 and the valve for the backwash effluent that pipes the effluent to the equalization tank (T-1). Allow clean water to sit on the fresh carbon for at least 24 hours, then repeat the backwash procedure for another 15 minutes. The LPAC unit is now ready to bring on-line. Once the unit is on line, record the pressure off of the gauge on top of the vessel. After 3 days of operation, repeat the 15-minute backwash procedure and note any changes to the pressure reading after the vessel is back on line.

Note: Arrange the LPAC valving such that the unit with the recently changed-out carbon is placed in the lag position, or arranged so that the wastewater flows through that unit last.

*****WARNING******

Activated carbon can reduce oxygen levels when placed inside of the LPAC vessels. Always use low-oxygen safety procedures when entering an LPAC vessel that either contains carbon or from which carbon has been removed.

3.1.9.2 Carbon Removal

Spent carbon may be removed by vacuum or pressure. If vacuum is selected, a vac-truck or drum vacuum may be used. The vessel must be drained, and the top manway may be removed for ease of access. The carbon can be removed with a nonmetallic pipe or hose though the top manway, or through the adsorbent drain lines at the bottom of each vessel.

If pressure is to be used to remove the carbon slurry, a compressed airline can be connected to the quick connect air fitting on top of the vessel. The required air pressure will normally depend on the length of carbon discharge line and the elevation of the final point of discharge. Open the manway and wash any remaining carbon into the bottom of the head, close the manway, and repeat the air pressure steps.

If the carbon will be removed by pressure, it must be extracted through the 2-inch (bottom) adsorbent outlet on the vessel. The carbon slurry outlet line should be connected to a vented receiving container prior to carbon removal. The receiving container should have a drain for removing excess water from the carbon prior to transportation.

The spent activated carbon removed from the LPAC unit(s) should be placed in Department of Transportation-approved drums placed on palettes, properly labeled, and stored temporarily on site. Spent activated carbon will be periodically transported under waste manifest off site to a facility previously approved by the Louisiana Department of Environmental Quality (LDEQ) for disposal or regeneration. Spent activated carbon will be transported to the disposal-regeneration facility within 90 days of its removal from the LPAC filter vessels.

Change-out of the LPAC will be considered to be handling of hazardous materials and will be performed in a manner consistent with the site health and safety plan. Appropriate personal protective equipment (PPE) should be used while performing the activated carbon change-out.

3.1.10 Routine Maintenance and Inspection for the Vapor-phase Activated Carbon Canisters

Maintenance and inspection of the VPAC units is related to the WWTP effluent quality monitoring program described in Section 3.4. If rising levels of VOCs are detected in the VPAC outlet vent, the activated carbon in the VPAC units may need to be replaced. As data is collected from the operation of the DNAPL recovery system and WWTP, more specific procedures for monitoring the effectiveness of the VPAC units should be added to this O&M manual.

An inspection of the VPAC units should be conducted and recorded on the forms included in Section 4.0 at least weekly.

3.1.11 Routine Maintenance and Inspection for the Pumps

Routine maintenance of the pumps in the WWTP building should be conducted in accordance with the manufacturer's recommendations. An inspection of the pumps should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding the field repair and obtaining parts or service for the pumps is provided in the manufacturer's O&M manuals in Appendix A.

At a minimum, pumps and pump motors should be checked while in operation for excessive heat buildup or unusual noises.

3.1.12 Routine Maintenance and Inspection for the Level Meters

No routine maintenance is required for the electronic level meters. However, the site glasses on the equalization tank (T-1), the OWS tank (T-2), the DNAPL storage tank (T-3), the LNAPL storage tank (T-5), and the OWS effluent tank (T-7) will require weekly cleaning. The site glass ports should be unscrewed and a brush used to remove buildup from the inside of the site glass. A cleaning solvent (such as WD-40) may be used to ensure that a thin film of buildup does not remain.

An inspection of the level meters should be conducted and recorded on the forms included in Section 4.0 at least weekly. Maintenance activities should also be recorded on the forms included in Section 4.0.

Information regarding the servicing of the level meters is provided in the manufacturer's O&M manual in Appendix A.

3.1.13 Routine Maintenance and Inspection for the Flow Meter

No routine maintenance of the flow meter is required. An inspection of the flow meter should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding obtaining service for the flow meter is provided in the manufacturer's O&M manual in Appendix A.

3.1.14 Routine Maintenance and Inspection for the Piping

No routine maintenance of the piping is required. An inspection of the piping in the DNAPL recovery vaults and WWTP should be conducted and recorded on the forms included in Section 4.0 at least weekly. Document any significant variations in product delivery from the recovery trenches.

Should a substantial drop in the production rate occur, clean-out of the DNAPL recovery trench is likely warranted. Should clean-out of the corrugated HDPE recovery trench lines be warranted, the following steps should be taken:

1. Isolate the vault tied to the recovery line by first shutting down the two pumps at the control panel. Follow all lock-out/tag-out procedures, as specified in the site health and safety plan before attempting any work inside the vault.

2. Disconnect the drive belts from the pump motors and remove the pumps from the risers.

3. Clean out the trench using the appropriate method (shown in the plans), run a high pressure water jet through the line from the clean-out area toward each riser.

4. Clean out the resulting residue in each riser from the recovery trenches with a nonmetallic stringer attached to a vacuum tract.

3.1.15 Routine Maintenance and Inspection for the Valves

Operating personnel should open and close each valve associated with the DNAPL recovery system and WWTP to ensure a full range of motion. Any problems should be remediated immediately. An inspection of the valves should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding obtaining service for the valves is provided in the manufacturer's O&M manual in Appendix A.

3.1.16 Routine Maintenance and Inspection for the Programmable Logic Controller

No routine maintenance is required for the PLC. An inspection of PLC operation should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding the servicing of the PLC is provided in the manufacturer's O&M manual in Appendix A.

3.1.17 Routine Maintenance and Inspection for the Sump Float Switches

No routine maintenance is required for the sump float switches. An inspection of the sump level meter should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding obtaining service for the level meter is provided in the manufacturer's O&M manual in Appendix A.

3.1.18 Routine Maintenance and Inspection for the Leak Detection System

No routine maintenance is required for the LDS. An inspection of the LDS should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding obtaining service for the LDS is provided in the manufacturer's O&M manual in Appendix A.

3.1.19 Routine Maintenance and Inspection for the WWTP Water Well

Drain the pressure tank every 2 months to remove any accumulated sediment. An inspection of the WWTP water well should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Information regarding the field repair of the water well pump is provided in the manufacturer's O&M manuals in Appendix A.

3.1.20 Routine Maintenance and Inspection for the Wiring

No routing maintenance is required for the wiring. An inspection of the wiring should be conducted and recorded on the forms included in Section 4.0 at least weekly.

Any frayed or stripped wiring encountered, however, should be addressed immediately by a qualified electrician to prevent any undue or unscheduled shutdown of the plant and to eliminate any potential fire hazards.

3.1.21 Routine Maintenance and Inspection for the Building Structural

No routine maintenance is associated with the building structure, however, following every major storm or hurricane, a visual inspection of the building shell is warranted to ensure that visibility of the building is maintained.

3.2 LONG-TERM SHUTDOWN PROCEDURES

The following subsections describe procedures for shutting down the DNAPL recovery system and WWTP for long periods of time (greater than 1 month). These procedures must be implemented prior to long-term shutdown in order to protect equipment coatings and instrumentation.

3.2.1 Long-term Shutdown Procedures for the Extraction Pumps (P-1 through P-10)

The following procedures should be followed for long-term shutdown of the extraction pumps:

- Shut down the pumps at the control panel and institute appropriate lock-out/tag-out procedures, as specified in the site health and safety plan.
- Isolate each riser pump from the 3-inch delivery line by closing the ball valve closest to that line on the 1-inch pump effluent line.
- Release any line pressure by slowly opening the sampling port valve into an appropriate container.

3.2.2 Long-term Shutdown Procedures for the Dense Nonaqueous-phase Liquid Recovery System Riser Level Meters

No special procedures exists for long-term shutdown of the DNAPL recovery system level meters.

3.2.3 Long-term Shutdown Procedures for the Dense Nonaqueous-phase Liquid Recovery System Riser Flow Meters

The following procedure should be followed for long-term shutdown of the DNAPL recovery system flow meters:

- Drain the liquid from the manifold surrounding the flow meter.

3.2.4 Long-term Shutdown Procedures for the Dense Nonaqueous-phase Liquid Transfer Pipeline

The following procedures should be followed for long-term shutdown of the DNAPL transfer pipeline:

- Drain the liquid from the transfer pipeline.
- Clean out the pipeline in accordance with the procedures in Section 3.1.

3.2.5 Long-term Shutdown Procedures for the Wastewater Treatment Plant

Long-term shutdown of the equalization tank (T-1) warrants a complete shutdown of the plant. Every effort should be made to remove as much product as is possible from all of the tanks, filters, and piping. The best way to accomplish this is to run pumps P-13, P-14, and P-15 in manual mode, with a continuous feed of fresh water to the equalization tank (T-1). First, shut down extraction well pump P1-10 and let the system equalize; then, begin routing freshwater from the backwash tank (T-6) back to the equalization tank (T-1), allowing the system to continue running in automatic mode. After the appearance of product is no longer evident in the influent to T-2, shut down P-15, then cycle P-14 in manual mode to remove any remaining product in T-2 to the DNAPL storage tank (T-3). Remove the contents of the LNAPL and DNAPL tanks in the appropriate manner, then flush with fresh water while the vacuum truck is still connected to the line. After the vessels and filters have been flushed with fresh water, cycle all pumps in manual mode, then isolate by closing the nearest upstream and downstream valves. Follow the procedures for individual components, as specified in Section 2.

3.2.6 Long-term Shutdown Procedures for the Sand Filters

The following procedures should be followed for prolonged sand filter shutdown:

1. Close the influent (feed) and effluent (discharge) valves to the filter(s) to be shut down.
2. Open the vent valve and drain the line to the vessel. After the water has drained, close the vent and the drain.
3. Open the manway and lubricate the threaded closure, if necessary. Replace the gasket if any evidence of tears or dryrot is evident.
4. Inspect the under drain assembly and the media pack. If the media is contaminated, remove the foreign material and replace the media, if necessary.
5. Replace the manway and secure the closure.
6. Lock-out or tag-out the valves to identify that the vessel is out of commission.

3.2.7 Long-term Shutdown Procedures for the Liquid-phase Activated Carbon Units

Long-term shutdown procedures for the LPAC units are the same as the shutdown procedures described in Section 2.2.7.5.

3.2.8 Long-term Shutdown Procedures for the Vapor-phase Activated Carbon Canisters

Long-term shutdown procedures for the LPAC units are the same as the shutdown procedures described in Section 2.2.8.5.

3.2.9 Long-term Shutdown Procedures for the Water Wells

Long-term shutdown procedures for the water wells are the same as the shutdown procedures described in Section 2.2.9.5.

3.3 MONITORING PROGRAM

This section describes the procedures for the collection of ground water samples from the on-property ground water monitoring well, RA-5, and the 2 on-property water wells (see Drawing C-10). This section also describes the procedures for the collection of WWTP effluent samples.

The monitoring program will be conducted throughout the life of the Remedial Action (RA), but may require modification as conditions change. Table 3-1 outlines the frequency of monitoring over the projected 30-year period of performance. Table 3-2 summarizes the number of samples to be collected over the 30-year life of the plan.

The objectives of the monitoring program are as follows:

- Identify lateral and vertical extent of ground water contamination.
- Track the rate and direction of both horizontal and vertical movement of ground water contamination to determine the impact on beneficial uses and the threat to nearby receptors.

TABLE 3-1

GROUND WATER MONITORING PROGRAM

Sampling Location	Number of Sampling Locations	Sample Location	Frequency
On-property Monitoring Well RA-5	1	Northeast	Semiannually
On-property Monitoring Well No. 1	1	Southeast corner	Annually
On-property Monitoring Well No. 2	1	Northwest corner	Annually
Wastewater Treatment Plant Effluent	1	WWTP	See Table 3-3

TABLE 3-2

SUMMARY OF 30-YEAR GROUND WATER SAMPLING PLAN

Sampling Location	Sample Medium	Sampling Method	Analytical Parameters	Number of Samples[a]	Laboratory Quality Control Samples			
					MS/MSD[b] (1 per 20)	Duplicate (1 per 10)	Trip Blank[c]	Field Blank[d]
On-property Monitoring Well RA-5	Ground water	Bailer	PAHs BTEX	60	3	6	16	10
WWTP Effluent	Treated water	Container	VOC	360	18	36	360	NA
			SVOC	1,560	78	156	NA	NA
			Metals	360	NA	36	NA	NA
			BOD-5	1,560	NA	156	NA	NA
			COD	10,950	NA	1,095	NA	NA
			TOC	10,950	NA	1,095	NA	NA
			TDS	360	NA	36	NA	NA
			TSS	1,560	NA	156	NA	NA
			O&G	1,560	NA	156	NA	NA
			Cl^{-} - $SO4^{-2}$	360	NA	36	NA	NA
			Turbidity	1,560	NA	156	NA	NA
			DO	1,560	NA	156	NA	NA
			pH	1,560	NA	156	NA	NA

Notes:

[a] Total number of samples is an estimate.

[b] A total of three times the volume of the sample will be required for laboratory quality control samples. MSDs are not required for inorganic analysis.

[c] Trip blanks are required for volatile organic analysis only. Trip blanks will be prepared and supplied by the contractor laboratory. The field sampler will place one trip blank (consisting of two 40-[mL] vials filled with organic-free water) in each sample shipping cooler that contains samples to be analyzed for volatile organic compounds.

[d] Equipment rinsates will be collected at a frequency of 1 per 10 samples by pouring distilled and deionized water over decontaminated sampling equipment to verify sufficient decontamination. Equipment rinsates will be analyzed for the same constituents as the samples being collected. If dedicated or disposable equipment is used, no equipment rinsates are necessary.

TABLE 3-2

SUMMARY OF 30-YEAR GROUND WATER SAMPLING PLAN

TABLE 3-2 (Continued)

SUMMARY OF 30-YEAR GROUND WATER SAMPLING PLAN

Notes: (Continued)

BOD_5	Biochemical oxygen demand
BTEX	Benzene, toluene, ethylbenzene, and xylene
Cl^-	Chlorine
COD	Chemical oxygen demand
DO	Dissolved oxygen
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
O&G	Oil and grease
PAH	Polynuclear aromatic hydrocarbons
SO_4^{+2}	Sulfate
SVOC	Semivolatile organic compound
TDS	Total dissolved solids
TOC	Total organic carbon
TSS	Total suspended solid
VOC	Volatile organic compound
WWTP	Wastewater treatment plant

- Demonstrate that the WWTP effluent meets the State of Louisiana discharge requirements.
- Provide a long-term monitoring strategy that includes identifying the constituents of concern, monitoring locations, frequency, and analytical methods.
- Develop a program that has documentable quality assurance (QA) and quality control (QC) and defined procedures for sample recovery, analysis, and well maintenance.
- Perform analysis of collected ground water data to perform hydrologic analysis that include the determination of flow directions, gradients, and potential seasonal variations in the hydraulic systems.

The applicability of these objectives will vary over time as they progress through the life of the project.

3.3.1 Sampling Activities

The following subsections describe the sampling activities for the on-property monitoring wells, residential wells, and WWTP effluent.

3.3.1.1 Monitoring Well Sampling Activities

Information regarding the construction of the on-property monitoring wells are included in Appendix A.30 and Drawing C-27.

Prior to sampling, monitoring wells will be unlocked and uncapped by site personnel to allow them to vent. If necessary, personnel will unlock the wells while wearing appropriate PPE. The wellhead will be monitored with an organic vapor analyzer to determine appropriate PPE for sampling event as described in the health and safety plan. The sampling team will use an interface probe to determine (1) the presence of multiple phases, (2) static water level, and (3) total depth of the well. The presence of multiple phases also will be verified visually with a translucent bailer. At least 3 well volumes of water will be removed from each well by hand bailing. Sampling will begin after the well has recharged and reached at least 75 percent of its equilibrium conditions, static water level, temperature, pH, conductivity, and salinity. If the parameters do not stabilize, additional purging will be required. A representative fraction of ground water from each well will be placed directly into the appropriate containers; the volatile organic analysis fraction

TABLE 3-3

**LOUISIANA EFFLUENT LIMITATIONS
FOR MADISONVILLE CREOSOTE WORKS PROPERTY**

will be collected first. Sample containers will be sealed with Teflon® tape to prevent leakage and then stored in an ice chest at 4 °C. For low-volume, slow-recharge wells, purging will only be conducted until (1) the static water level, temperature, pH, conductivity, and salinity measurements have stabilized, indicating that fresh formation water fills the well; or (2) the well is dry. The sampling team will allow the well to recharge for 24 hours prior to sampling.

Ground water samples will be submitted to an analytical laboratory for analysis. All purge water will be placed in appropriate containers and transferred to the decontamination pad, where it can be pumped to the WWTP for treatment.

3.3.1.2 Wastewater Treatment Plant Effluent Sampling Activities

Table 3-3 presents the State of Louisiana's effluent limitation parameters for treated wastewater. This table also provides the sampling frequency for each constituent and the type sample to be collected. The parameters listed in Table 3-3 shall be followed if the system has a continuous discharge. If the system is operated in the batch mode, the parameters of Table 3-3 shall apply prior to discharge. Constituents in Table 3-3 that are in boldface type represent constituents present at the MCW site. Initially, the wastewater will be sampled for all Table 3-3 constituents; however, once the wastewater treatment system is operating within normal operating conditions, only the constituents indicated in Table 3-3 in bold print will be analyzed.

3.3.2 Quality Assurance Plan

This section addresses the requirements for consistent collection of quality ground water and WWTP effluent samples and data.

TABLE 3-3

LOUISIANA EFFLUENT LIMITATIONS FOR MADISONVILLE CREOSOTE WORKS PROPERTY

Constituent	Maximum Effluent Limitations	Sampling Frequency	Sample Type
BOD_5	**20 mg/L**	**One per week**	**Composite**
COD (Total)	**70 mg/L**	**One per day**	**Composite**
TOC (Total)	**35 mg/L**	**One per day**	**Composite**
TSS	**45 mg/L**	**One per week**	**Composite**
TDS	**Report**	**One per month**	**Composite**
Oil and Grease	**15 mg/L**	**One per week**	**Composite**
Chloride	Report	One per month	Composite
Sulfate	Report	One per month	Composite
Turbidity	50 NTU	One per week	Composite
Dissolved Oxygen, Minimum	5 mg/L	One per week	Grab
pH	6.0 to 8.5 s.u.	One per week	Grab
Arsenic	0.05 mg/L	One per month	Composite
Total Chromium	0.15 mg/L	One per month	Composite
Zinc	0.5 mg/L	One per month	Composite
Volatile Organic Compounds			
Acrolein	100 ppb	One per month	Composite
1,1,2,2-Tetrachloroethane	100 ppb	One per month	Composite
2-Chloroethyl Vinyl Ether	100 ppb	One per month	Composite
Methyl Bromide	100 ppb	One per month	Composite
Bromoform	100 ppb	One per month	Composite
Dichlorobromomethane	100 ppb	One per month	Composite
Volatile Organic Compounds (Continued)			
Chlorodibromomethane	100 ppb	One per month	Composite
Acrylonitrile	232 ppb	One per month	Composite
Benzene	**134 ppb**	**One per month**	**Composite**

TABLE 3-3 (Continued)

LOUISIANA EFFLUENT LIMITATIONS FOR MADISONVILLE CREOSOTE WORKS PROPERTY

Constituent	Maximum Effluent Limitations	Sampling Frequency	Sample Type
Toluene	**74 ppb**	**One per month**	**Composite**
Ethylbenzene	**380 ppb**	**One per month**	**Composite**
Carbon Tetrachloride	380 ppb	One per month	Composite
Chlorobenzene	380 ppb	One per month	Composite
1,2-Dichloroethane	574 ppb	One per month	Composite
1,1,1-Trichloroethane	59 ppb	One per month	Composite
1,1-Dichloroethane	59 ppb	One per month	Composite
1,1-Dichloroethylene	60 ppb	One per month	Composite
1,1,2-Trichloroethane	127 ppb	One per month	Composite
Chloroethane	295 ppb	One per month	Composite
Chloroform	325 ppb	One per month	Composite
1,2-Dichloropropane	794 ppb	One per month	Composite
1,3-Dichloropropylene	794 ppb	One per month	Composite
Methylene Chloride	170 ppb	One per month	Composite
Methyl Chloride	295 ppb	One per month	Composite
Tetrachloroethylene	164 ppb	One per month	Composite
Trichloroethylene	69 ppb	One per month	Composite
Vinyl Chloride	172 ppb	One per month	Composite
1,2-trans-dichloroethylene	66 ppb	One per month	Composite

TABLE 3-3 (Continued)

LOUISIANA EFFLUENT LIMITATIONS FOR MADISONVILLE CREOSOTE WORKS PROPERTY

Constituent	Maximum Effluent Limitations	Sampling Frequency	Sample Type
Semivolatile Organic Compounds (Base Neutral Extractable Organic Compounds) [a,c]			
bis (2-Chloroethoxy) Methane	100 ppb	One per week	Composite
2-Chloronaphthalene	100 ppb	One per week	Composite
Isophorone	100 ppb	One per week	Composite
4-Bromophenyl Phenyl Ether	100 ppb	One per week	Composite
Benzo(b)fluoranthene	**100 ppb**	**One per week**	**Composite**
Indeno(1,2,3-cd)anthracene	**100 ppb**	**One per week**	**Composite**
Dibenzo(a,h)anthracene	**100 ppb**	**One per week**	**Composite**
Benzo(g,h,i)perylene	**100 ppb**	**One per week**	**Composite**
4-Chlorophenyl Phenyl Ether	100 ppb	One per week	Composite
3,3-Dichlorobenzidine	100 ppb	One per week	Composite
bis(2-chloroethyl)ether	100 ppb	One per week	Composite
1,2-Diphenylhydrazine	100 ppb	One per week	Composite
Hexachlorocyclopentadiene	100 ppb	One per week	Composite
N-Nitrosodiphenylamine	100 ppb	One per week	Composite
Di-n-octyl Phthalate	100 ppb	One per week	Composite
Butyl Benzyl Phthalate	100 ppb	One per week	Composite
N-nitrosodimethylamine	100 ppb	One per week	Composite
N-nitrosodi-n-propylamine	100 ppb	One per week	Composite
1,2-Dichlorobenzene	794 ppb	One per week	Composite
1,3-Dichlorobenzene	380 ppb	One per week	Composite
1,4-Dichlorobenzene	380 ppb	One per week	Composite
1,2,4-Trichlorobenzene	794 ppb	One per week	Composite
Semivolatile Organic Compounds (Base Neutral Extractable Organic Compounds) [a,c] (Continued)			
Hexachloroethane	794 ppb	One per week	Composite

TABLE 3-3 (Continued)

LOUISIANA EFFLUENT LIMITATIONS FOR MADISONVILLE CREOSOTE WORKS PROPERTY

Constituent	Maximum Effluent Limitations	Sampling Frequency	Sample Type
Naphthalene	**47 ppb**	**One per week**	**Composite**
Nitrobenzene	6,402 ppb	One per week	Composite
2,4-Dinitrotoluene	100 ppb	One per week	Composite
2,6-Dinitrotoluene	100 ppb	One per week	Composite
bis(2-ethylhexyl)phthalate	258 ppb	One per week	Composite
Phenanthrene	**47 ppb**	**One per week**	**Composite**
Anthracene	**47 ppb**	**One per week**	**Composite**
Benzo(a)anthracene	**47 ppb**	**One per week**	**Composite**
Benzo(k)fluoranthene	**47 ppb**	**One per week**	**Composite**
Benzo(a)pyrene	**48 ppb**	**One per week**	**Composite**
Dimethyl Phthalate	47 ppb	One per week	Composite
Di-n-butyl Phthalate	43 ppb	One per week	Composite
Fluorene	**47 ppb**	**One per week**	**Composite**
Fluoranthene	**54 ppb**	**One per week**	**Composite**
Chrysene	**47 ppb**	**One per week**	**Composite**
Pyrene	**48 ppb**	**One per week**	**Composite**
Acenaphthylene	**47 ppb**	**One per week**	**Composite**
Acenaphthene	**47 ppb**	**One per week**	**Composite**
bis(2-Chloroisopropyl)ether	794 ppb	One per week	Composite
Diethyl Phthalate	113 ppb	One per week	Composite
Benzidine	100 ppb	One per week	Composite
Semivolatile Organic Compounds (Acid Extractable Organic Compounds) [c]			
Pentachlorophenol	100 ppb	One per week	Composite
p-Chlorophenol	100 ppb	One per week	Composite
2,4,6-Trichlorophenol	100 ppb	One per week	Composite

TABLE 3-3 (Continued)

LOUISIANA EFFLUENT LIMITATIONS
FOR MADISONVILLE CREOSOTE WORKS PROPERTY

Constituent	Maximum Effluent Limitations	Sampling Frequency	Sample Type
Phenol	47 ppb	One per week	Composite
2-Nitrophenol	1,231 ppb	One per week	Composite
4-Nitrophenol	576 ppb	One per week	Composite
2,4-Dinitrophenol	4,291 ppb	One per week	Composite
4,6-Dinitro-o-cresol	277 ppb	One per week	Composite
2-Chlorophenol	100 ppb	One per week	Composite
2,4-Dichlorophenol	100 ppb	One per week	Composite
2,4-Dimethylphenol	47 ppb	One per week	Composite

Notes:

a Base neutral extractable organic compounds will be sampled and analyzed at a frequency of three times per week for the first 2 months of operation and then once per week thereafter.
b Composite samples will be stored at 4 °C.
c Samples will be collected weekly for the first year and monthly thereafter.

BOD Biochemical oxygen demand
COD Chemical oxygen demand
mg/L Milligrams per liter
NTU Nephelometric tubidity unit
ppb Parts per billion
s.u. Standard units
TDS Total dissolved solids
TOC Total organic carbon
TSS Total suspended solids

3.3.2.1 Sample Container, Volume, Preservation, and Holding Time Requirements

Table 3-4 specifies the required sample types, volumes, container types, preservation techniques, and holding times for each ground water sample and WWTP effluent sample. The required containers, preservation techniques, and holding times for QC samples (such as field duplicates, field blanks, trip blanks, equipment rinsate, and matrix spikes and matrix spike duplicates [MS/MSD]) will be the same, however, additional volumes (described in Table 3-4) may be required.

3.3.2.2 Sampling Methods

Sampling methods and equipment will be selected to meet project objectives. Field parameters (such as pH, specific conductance, temperature, meteorological parameters, and water elevation) will be measured during sampling procedures.

To the extent possible, the sampling team will rely on EPA-approved methods for sample collection and field measurements. The sampling team will use the field standard operating procedures (SOP) listed in Table 3-5 for sampling. These SOPs are included as Appendix B.

The sampling team will be responsible for addressing failures in the sampling or measurement systems and will implement corrective action in these situations. In general, corrective action for field sampling and measurement failures include recalibration of instruments, replacement of malfunctioning measurement instruments or sampling equipment, and resampling or repetition of measurements.

3.3.2.3 Sample Handling and Custody Requirements

Each sample collected will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Sample integrity helps to ensure the legal defensibility of the analytical data and subsequent conclusions. The sampling team will use standard EPA procedures to identify, track, monitor, and maintain chain-of-custody (COC) for all samples. These procedures include the following:

- Field COC procedures

TABLE 3-4

REQUIRED SAMPLE PARAMETERS, ANALYSES, VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Matrix	Parameter	Analytical Method[bd]	EPA Requirements for Volume and Containers	LDEQ Requirements for Volume and Containers	Preservation Techniques	Holding Time	
						Extraction	Analysis
Ground Water	SVOC	SW-846 3520C/8270C	Two 1-L amber glass jars with Teflon™-lined caps	1-gallon jug or four 1-liter bottles, amber glass, with Teflon-liner in cap	Store at 4 °C	7 days	40 days
	BTEX	SW-846 8021B	Two 40-mL glass vials with Teflon™-lined septa	Three 40-ml VOC vials with 0.5 ml 1:1 HCl, no head space	Store at 4 °C	7 days	7 days[a]
WWTP Effluent	VOC	SW-846 Method 8260B	Two 40-mL vials with Teflon™-lined cap	Three 40-ml VOC vials with 0.5 ml 1:1 HCl, no head space	HCl; Store at 4 °C	NA	14 days
	SVOC	SW-846 Method 8270C	Two 1-L amber glass jars with Teflon™-lined cap	1-gallon jug or four 1-liter bottles, amber glass, with Teflon-liner in cap	Store at 4 °C	14 days	40 days
	Metals [c]	MCAWW Method 200.7	One 1,000-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	180 days
	BOD-5	MCAWW Method 405.1	One 500-mL amber glass jar with Teflon™-lined cap	1-liter cubitainer	Store at 4 °C	48 hours	5 days

TABLE 3-4 (Continued)

REQUIRED SAMPLE PARAMETERS, ANALYSES, VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Matrix	Parameter	Analytical Method[bd]	EPA Requirements for Volume and Containers	LDEQ Requirements for Volume and Containers	Preservation Techniques	Holding Time	
						Extraction	Analysis
	COD	MCAWW Method 410.4	One 500-mL amber glass jar with Teflon™-lined cap	8-oz plastic, rectangular bottle	H_2SO_4; store at 4 °C	NA	28 days
WWTP Effluent (Continued)	TOC	MCAWW Method 415.1	One 500-mL amber glass jar with Teflon™-lined cap	8-oz plastic, rectangular bottle	Store at 4 °C	NA	28 days
	TDS	MCAWW Method 160.1	One 500-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	7 days
	TSS	MCAWW Method 160.2	One 500-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	7 days
	O&G	MCAWW Method 413.2	One 1-L amber glass jar with Teflon™-lined cap	Two 1-liter clear, wide-mouth glass jars, with Teflon-liner in cap	HCl; store at 4 °C	28 days	40 days
	Chloride and sulfate	MCAWW Method 300	One 250-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	28 days
	Turbidity	MCAWW Method 180.1	One 250-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	48 hours
	DO	MCAWW Method 360.1	One 250-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	24 hours[d]

TABLE 3-4 (Continued)

REQUIRED SAMPLE PARAMETERS, ANALYSES, VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Matrix	Parameter	Analytical Method[bd]	EPA Requirements for Volume and Containers	LDEQ Requirements for Volume and Containers	Preservation Techniques	Holding Time	
						Extraction	Analysis
	pH	MCAWW Method 150.1	One 250-mL polyethylene bottle	1-liter plastic, cylindrical bottle	Store at 4 °C	NA	24 hours[d]

TABLE 3-4 (Continued)

REQUIRED SAMPLE PARAMETERS, ANALYSES, VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Notes:

[a]	SW-846 represents the EPA document, Test Methods for Evaluating Solid Waste.
[b]	MCAWW represents the EPA document, Methods for Chemical Analysis of Water and Wastes.
[c]	Total metals include arsenic, chromium, and zinc only.
[d]	Because chemical preservations are not recommended for ground water samples in this area of Region 6, the holding times must be reduced to 7 days for all aromatic compounds.
[e]	These analytes must be analyzed immediately; an on-site water quality meter may be used to perform these tests.

BOD-5	Biochemical oxygen demand (5-day)
BTEX	Benzene, toluene, ethylbenzene, and xylenes
°C	Degrees centigrade
COD	Chemical oxygen demand
DO	Dissolved oxygen
EPA	U.S. Environmental Protection Agency
HCl	Hydrochloric acid
H_2SO_4	Sulfuric acid
L	Liter
MCAWW	Methods of Chemical Analysis of Water and Wastes
mL	Milliliter
NA	Not applicable
O&G	Oil and grease
SVOC	Semivolatile organic compound
SW-846	Test Methods for Evaluating Solid Waste
TDS	Total dissolved solids
TOC	Total organic carbon
TSS	Total suspended solids
VOC	Volatile organic compound
WWTP	Waste water treatment plant

TABLE 3-4 (Continued)

REQUIRED SAMPLE PARAMETERS, ANALYSES, VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

TABLE 3-5

FIELD STANDARD OPERATING PROCEDURES

SOP Number	SOP Title
002	General Equipment Decontamination
003	Organic Vapor Monitoring
011	Field Measurement of Water Temperature
012	Field Measurement of pH
013	Field Measurement of Specific Conductance
014	Static Water Level, Total Well Depth, and Immiscible Layer Measurement
015	Ground Water Sample Collection Using Micropurge Technology
019	Packaging and Shipping Samples
024	Recording of Notes in Field Logbooks

Note:

SOP Standard operating procedure

- Field procedures
- Field logbooks
- Laboratory COC procedures

3.3.2.4 Laboratory Analytical Methods

Laboratory analyses of field samples will be conducted by an approved LDEQ analytical laboratory that is acceptable to EPA. Tables 3-2 and 3-4 lists the laboratory analytical methods. In all cases, appropriate methods of sample preparation, cleanup, and analyses are based on specific analytical parameters of interest, sample matrices, and required detection limits. EPA-approved analytical methods were taken from EPA guidance documents. LDEQ-approved analytical methods will be used when the LDEQ standard is more stringent than the EPA method.

3.3.2.5 Quality Control Requirements

Various types of field and laboratory QC samples and measurements will be used to verify that analytical data meet QA objectives. Field QC samples and measurements will be used to assess the influence of sampling activities and measurements on data quality. Similarly, laboratory QC samples will be used to assess the influence of a laboratory's analytical program on data quality. This section describes field and laboratory QC requirements for samples to be analyzed. Tables 3-2 and 3-4 and show the types of QC samples that will be collected. Table 3-2 presents the frequency of QC samples to be collected.

The description of field and QC requirements for samples provides definitions and typical collection and analysis frequencies of common field and laboratory QC samples and measurements. It also outlines the procedures used to assess field measurements, laboratory data, and common data quality indicators.

Field Quality Control Requirements

Field QC samples will be collected and analyzed to assess the quality of data generated by sampling activities. These samples may include trip blanks, field blanks, equipment rinsate blanks, field duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples (MS/MSD samples are laboratory QC samples that may require extra sample volumes to be collected in the field). Field QC measurements may include field duplicate measurements and checks of instrument responses against QC standards for measurements of pH, temperature, and conductivity.

Trip blanks are used to assess the potential for sample contamination during handling, shipment, and storage. Trip blanks are 40-milliliter vials filled with organic-free water. Trip blanks are sealed and transported to the field; kept with empty sample bottles, and then with the investigative samples, throughout the sampling event; and returned to the laboratory with the investigative samples for analysis. Trip blanks are never opened in the field. One trip blank is included within every shipping cooler of aqueous samples to be analyzed for VOCs. For this project, the trip blanks will be analyzed for total benzene, toluene, ethylbenzene, and xylenes (BTEX).

Field blanks are collected to determine the potential contamination or field samples from ambient conditions. Field blanks are required for aqueous sample matrices and consist of analyte-free water (degasified organic-free) water. One field blank is collected for each group of aqueous samples per day of sampling and is analyzed for BTEX.

Equipment rinsate blanks will not be required, because dedicated sampling equipment will be used.
Field duplicate samples are independent samples collected as close as possible, in space and time, to the original investigative sample. Immediately following collection of the original sample, the field duplicate sample is collected by using the same collection method. Field duplicate samples can measure the influence of sampling and field procedures on the precision of an environmental measurement. Typically, field duplicates are collected at a frequency of one for every 20 investigative samples of the same matrix type, and field duplicates are analyzed for the sample analytes for which the original samples were analyzed.

Typically, MS/MSD samples are collected for use as laboratory QC samples for analysis by organic methods. Aqueous samples are collected from one sampling location at triple the normal sample volume for all organic analyses. In the laboratory, MS/MSD samples are split, and two portions are spiked with known amounts of analytes. Analytical results for MS/MSD samples are used to measure the precision and accuracy of the laboratory organic analytical program.

QC checks for field measurements will consist mainly of initial and continuing calibration checks of field equipment. When applicable, QC check standards independent of the calibration standards will be used to check equipment performance. For example, to check the accuracy of field equipment (such as a pH meter), a standard buffer solution may be used independent of the calibration standards. Typically, precision of field measurements will be checked by taking duplicate measurements. The types and frequencies of field QC measurements and the QC limits for these measurements will be as specified in EPA-approved methods or the SOPs listed in Table 3-5.

Laboratory QC Requirements

All laboratories that perform analytical work under this project must adhere to a QA program that is used to monitor and control all laboratory QC activities. Each laboratory must have a written QA manual that describes the QA program in detail. The laboratory QA manager is responsible for ensuring that all laboratory internal QC checks are conducted in accordance with the analytical method requirements and the laboratory's QA manual.

Many of the laboratory QC procedures and requirements are described in EPA-approved analytical methods, laboratory method SOPs, and method guidance documents. However, if laboratory QC requirements are not specified in an analytical method or if requirements beyond those included in an analytical method are necessary to ensure that project QA objectives and data quality objectives (DQO) are met, the following information will be included in the data package:

- Laboratory analytical methods to which the internal QC check applies
- Complete procedures for conducting the internal QC check
- QC samples and QC measurements involved in the internal QC check
- Complete collection and preparation procedures for the QC samples

- Spiking analytes and concentrations
- Control limits for the internal QC check
- Corrective action procedures to be followed if the internal QC check is not performed properly or results are outside of control limits

Laboratory QC procedures and requirements may include the preparation and analysis of various QC checks. The following list describes laboratory control samples; method blanks; MSs, MS/MSDs, and matrix duplicates (MD); and surrogate spikes (these QC checks are most frequently required).

Laboratory control samples are well-characterized, laboratory-generated samples that are used to monitor the laboratory's day-to-day performance of analytical methods. The results of laboratory control sample analyses are compared to well-defined laboratory control limits to determine whether the laboratory system is in control for the particular method. If the system is not in control, corrective action is implemented. Appropriate corrective actions include (1) stopping the analysis, (2) examining instrument performance or sample preparation and analysis information, and (3) determining whether samples should be reprepared or reanalyzed.

Method blanks, which are also known as analytical process or preparation blanks, are analyzed to assess the level of background interference or contamination in the analytical system and the level that may lead to the reporting of elevated concentration levels or false positive data. Typically, one method blank is analyzed for every 20 samples processed by the analytical system. For batches of less than 20 samples, one method blank is analyzed with every batch of samples processed.

A method blank consists of reagents, specific to the analytical method, that are carried through every aspect of the analytical procedure, including sample preparation, cleanup, and analysis. The results of the method blank analysis are evaluated in conjunction with other QC information in order to determine the acceptability of the data generated for that batch of samples. Ideally, the concentration of target analytes in the method blank should be below the reporting limit for that analyte. For some common laboratory contaminants, a higher concentration may be allowed.

If the method blank for any analysis is beyond control limits, then the source of the contamination must be investigated and appropriate corrective action must be taken and documented. Investigation includes an evaluation of the data to determine the extent of the contamination and its effect on sample results. If a method blank is within control limits but indicates concentrations of analytes that are above the reporting limit, an investigation should be conducted to determine whether any corrective action could eliminate an ongoing source of target analytes.

For organic analyses, the concentrations of target analytes in the method blank must be below the reporting limit for that analyte for the blank to be considered acceptable. An exception may be made for common laboratory contaminants (such as methylene chloride, acetone, 2-butanone, and phthalate esters) that may be present in the blank at up to five times the reporting limit. These compounds are frequently detected at a low level in method blanks and result from materials used in collecting, preparing, and analyzing samples for organic parameters.

MSs, MSDs, and MDs are environmental samples. An MS is an environmental sample to which a known concentration of all target analytes has been added. The MS is used to evaluate the effect of the sample matrix on the accuracy of both organic and inorganic analyses. Each spike standard solution must be used alternately. The MS, in addition to an unspiked aliquot, is taken through the entire analytical procedure, and the recovery of the analytes is calculated. Results are expressed as percent recovery (%R).

For organic analyses, an MS/MSD is an environmental sample that is divided into two separate aliquots, each of which is spiked with a known concentration of target analytes. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as relative percent difference and %R and are compared to control limits that have been established for each analyte. If results fall outside of control limits, corrective action must be performed. Typically, one MS/MSD is analyzed for every 20 investigative samples that are prepared in one batch. For inorganic analyses, an MD is used to evaluate precision.

Surrogate spikes are organic compounds that are similar to the analytes of interest in chemical behavior but are not normally found in environmental samples. Surrogate spikes are added to samples before the samples are extracted in order to assess the efficiency of the extraction procedure and bias introduced by the sample matrix. Results are reported in terms of %R. Individual analytical methods may dictate sample reanalyses on the basis of surrogate criteria.

The laboratory will use surrogate recoveries primarily in order to assess the overall efficiency in implementing the method. Obvious problems with sample preparation and analysis (such as evaporation to dryness or a leaking septum) that can lead to poor surrogate spike recoveries must be eliminated before low surrogate recoveries are attributed to matrix effects.

3.3.2.6 Instrument and Equipment Testing, Inspection, and Maintenance Requirements

This section discusses general requirements applicable to field instruments and equipment and laboratory instruments, and it outlines applicable testing, inspection, and maintenance procedures. Equipment and instruments will be leased, as needed.

General Requirements

Testing, inspection, and maintenance methods and frequency will be based on (1) the type of instrument; (2) its stability characteristics; (3) the required accuracy, sensitivity, and precision; (4) its intended use, (5) manufacturer’s recommendations; and (6) other conditions affecting measurement or operational control. For most instruments, preventive maintenance is performed in accordance with procedures and schedules recommended in (1) the instrument manufacturer’s literature or O&M manual or (2) SOPs associated with particular applications of the instrument.

In some cases, testing, inspection, and maintenance procedures and schedules will differ from the manufacturer’s specifications or SOPs. This can occur when a field instrument is used to make critical measurements or when analytical methods associated with a laboratory instrument require more frequent testing, inspection, and maintenance.

Field Equipment and Instruments

Field equipment and instruments will be thoroughly checked and calibrated before shipment or transport to the field. The equipment supplier is responsible for checking the equipment that it leases to the sampling team. Copies of testing, inspection, and maintenance procedures will be shipped to the field with the equipment and instruments. Once in the field, the sampling team leader will assume responsibility for testing, inspection, and maintenance.

After arrival in the field, field equipment and instruments will be inspected for damage. Damaged equipment and instruments will be replaced or repaired immediately. Battery-operated equipment is checked to ensure full operating capacity; if needed, batteries are recharged or replaced. Critical spare parts, such as tape, paper, pH probes, electrodes, and batteries, will be kept on property to minimize equipment downtime. To prevent delays in the field schedule, backup instruments and equipment will be available on property or within a 1-day shipping period.

Following use, field equipment will be properly decontaminated before it will be returned to its source. When the equipment is returned, copies of any field notes regarding equipment problems will be included so that problems are not overlooked and any necessary equipment repairs are implemented.

Laboratory Instruments

All laboratories conducting analyses of samples collected are required to (1) have a preventive maintenance program covering: (2) testing, inspection, and maintenance procedures; and (3) the maintenance schedule for each measurement system and required support activity. This program is usually documented in the form of SOPs for each analytical instrument that will be used. Typically, the program will be laboratory-specific; however, it should follow requirements outlined in the analytical method or other EPA-approved guidelines. The basic requirements and components of such a program include the following:

- Each laboratory will conduct a routine preventive maintenance program that is part of its QA/QC program in order to minimize the occurrence of instrument failure and other system malfunctions.

- Service and repair of instruments, equipment, tools, and gauges will be performed by an internal group of qualified personnel. Alternatively, scheduled instrument maintenance and emergency repair may be provided by the manufacturer’s representatives under a repair and maintenance contract.

- Instrument maintenance will be implemented by the laboratory on a regularly scheduled basis. The servicing of critical items should be scheduled to minimize the downtime of the measurement system. The laboratory will prepare a list of critical spare parts for each instrument. These spare parts will be requested from the manufacturer and stored at the laboratory.

- Testing, inspection, and maintenance procedures described in laboratory SOPs will be in accordance with manufacturer’s specifications and with the requirements of the specific analytical methods used.

- All maintenance and service must be documented in service logbooks to provide a history of maintenance records. A separate service logbook should be kept for each instrument.
- All maintenance records will be traceable to the specific instrument, equipment, tool, or gauge. Records produced as a result of testing, inspection, or maintenance of laboratory instruments will be maintained and filed at the laboratory. These records will be available for review by internal and external laboratory system audits.

3.3.2.7 Instrument Calibration and Frequency

This section describes the procedures for maintaining the accuracy of field equipment and laboratory instruments used for field tests and laboratory analyses. The equipment and instruments should be calibrated before each use or, when not in use, on a scheduled, periodic basis.

Field Equipment

Equipment used to collect field samples or take field measurements will be maintained and calibrated with sufficient frequency and in such a manner that the accuracy and reproducibility of results are consistent with the manufacturer’s specifications and with specific DQOs.

Upon arrival, field sampling and measurement equipment will be examined by the sampling team leader to verify that it is in good working condition. The manufacturer's O&M manual and instructions that accompany the equipment will be consulted to ensure that all calibration procedures are followed.

Laboratory Instruments

All laboratory equipment used to analyze samples collected for the MCW site will be calibrated in accordance with written SOPs maintained by the laboratory. Calibration records (including the dates and times of calibration and the names of the personnel performing the calibration) will be (1) filed at the location at which the analytical work is performed and (2) maintained by the laboratory personnel performing QC activities. Calibration records will be subject to QA audits.

The laboratories will follow method-specific calibration procedures and requirements for laboratory measurements. Calibration procedures and requirements also will be provided, as appropriate, for laboratory support equipment, such as balances, mercury thermometers, pH meters, and other equipment used to take chemical and physical measurements. Calibration procedures and frequencies specified in the relevant methods will be followed exactly.

3.3.3 Alternative Procedures to Prevent Releases or Threatened Releases

Alternative procedures may be necessary to mitigate a release or threatened release of DNAPL or contaminated ground water outside of the area of influence of the DNAPL recovery system or property boundaries. The following alternatives may be used at the MCW site:

- Construct a French drain to intercept the DNAPL and contaminated ground water, as applicable, and treat it in the wastewater treatment system.
- Construct a pump and treat system to intercept the migrating contaminants using the on-property wastewater treatment system to treat the collected DNAPL and contaminated ground water, as applicable.
- Construct a slurry wall around the release.

Alternative procedures may be necessary to mitigate a release or threatened release of DNAPL or contaminated ground water from the WWTP. Additional components of the WWTP—including an air stripper and activated sludge treatment—are shown on Drawings M-3 and M-4. Should recurring problems with elevated effluent levels be encountered, construction of these components may be required.

3.3.4 Corrective Action

A corrective action plan will be recommended when sufficient data become available.

3.3.5 Recordkeeping Requirements

This section describes the data reporting requirements for field personnel and laboratories that submit field and laboratory measurement data and manage the data.

3.3.5.1 Data Reporting Requirements

Each analytical laboratory must prepare and submit data packages for review. The laboratories will deliver data packages that include, at a minimum, the following items.

A case narrative will be provided. It will include a statement of samples received, a description of any deviations from the specified analytical method, explanations of data qualifiers applied to the data, and any other significant problems encountered during analysis. The narrative will describe all QC nonconformances experienced during sample analysis, in addition to the corrective actions taken.

A field and laboratory sample table will be provided. The table will cross-reference field and laboratory sample numbers. COC forms included will pertain to each sample delivery group or sample batch analyzed.

The laboratory report will show traceability to the sample analyzed and contain the following information: project identification; field sample number; laboratory sample number; sample matrix description; dates and times of sample collection, receipt at the laboratory, sample preparation, and analysis; analytical method description and reference citation; individual parameter results with concentration units (including second column results or second detector results, or other confirmatory results, where appropriate); quantitation limits achieved; and dilution or concentration factors.

Data summary forms and QC summary forms will be provided. The QC summary forms will include forms for sample results; surrogate results; method blank results; field QC sample results; MS/MSD results; initial and continuing calibration results; confirmatory results, laboratory control sample results; and other QC sample results. Additional data deliverables also may be required, depending on the particular field or laboratory method.

Specific data reporting requirements may be required. These requirements, the turnaround time for receipt of the data deliverables specified, and any requirements for retention of samples and laboratory records will be defined clearly in requests for analytical services.

3.3.5.2 Data Management

Data for this project will be obtained from a combination of sources, including field measurements and analytical laboratories. The process of data gathering is a coordination effort and will be conducted by project staff in conjunction with all potential data producers. The data will be obtained from the analytical service provider, when appropriate, in the form of an electronic data deliverable, in addition to the required hard-copy analytical data package.

Data tracking is imperative to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample COC. When the analytical services provider receives the samples into custody, the provider will send a sample acknowledgment to the entity responsible for sampling. The sample acknowledgment will confirm the sample receipt, condition, and required analyses. The tracking program will contain all pertinent information about each sample and can track the data at each phase of the process. The tracking program carries the data through completion of the data review.

No definitive laboratory data will be validated. Instead, the data will be reviewed on the basis of reported QC results, and determinations of data quality will be assessed from QC summaries. For the MCW site, only field analytical data will be validated. The validation process will be abbreviated to include the review of calibration records, sample data results from readouts or field notes, and duplicate measurement precision.

Following data review, the entity responsible for sampling will be provided with the data for inclusion in the final report. In addition to the final report, all analytical data in the form obtained from the analytical services provider will be archived with the final project file.

3.3.5.3 Data Review and Reduction Requirement

This section focuses on data review and reduction requirements for work conducted for the RA monitoring.

Data reduction and review are essential functions required for preparing data that can be used effectively to support project decisions and DQOs. These functions must be performed accurately and in accordance with EPA-approved procedures and techniques. Data reduction includes all computations and data manipulations that produce the final results used during the investigation. Data review includes all procedures conducted by field or laboratory personnel to ensure that measurement results are correct and acceptable in accordance with QA objectives.

Field and laboratory measurement data reduction and review procedures and requirements are specified in field and laboratory methods, SOPs, and guidance documents. Field personnel will record all raw data from chemical and physical field measurements in a field logbook. The site operator has primary responsibility for (1) verifying that field measurements were made correctly, (2) confirming that sample collection and handling procedures were followed, and (3) ensuring that all field data reduction and review procedures requirements are followed. The site operator also has responsibility for assessing preliminary data quality and for advising the data user of any potential QA/QC problems with field data. When field data are used in a project report, data reduction methods will be fully documented in the report.

Each analytical laboratory will complete data reduction for chemical and physical laboratory measurements and will complete an in-house review of all laboratory analytical results. The laboratory QA manager is responsible for ensuring that all laboratory data reduction and review procedures follow the requirements identified herein. The laboratory QA manager also is responsible for assessing data quality and for advising the QA officer of the entity responsible for sampling of possible QA/QC problems with laboratory data.

3.3.5.4 Reporting Schedule and Content

Reports will be prepared for all ground water monitoring and WWTP effluent sampling events and will provide a brief discussion and interpretation of the sampling event's results. The reports also will provide summary tables with the following information:

- Water level data
- Water quality data
- Analytical results
- QA/QC results

In addition, the reports will provide maps, as appropriate, showing ground water elevation contours and contaminant concentrations. The annual report will include an evaluation and discussion of the monitoring well and WWTP effluent analytical data and results for the past four quarters, a discussion of anomalous data, and an evaluation and discussion of MCW site hydrologic systems. The annual report will:

- Present and discuss WWTP effluent quality results and trends.
- Present and discuss changes in aquifer potentiometric levels and gradients.
- Present water quality data with a discussion of plume configuration.
- Discuss any changes in the existing hydrological concept.
- Identify data gaps and potential deficiencies in the monitoring system.
- Update the ground water monitoring sampling frequency analyses and water level measurements and include recommended revisions to the monitoring program.

Quarterly and annual reports will be prepared and submitted as MCW site and background data become available.

3.3.5.5 Validation and Verification Methods

No definitive laboratory data will be validated. Instead, the data will be reviewed on the basis of reported QC results, and determinations of data quality will be assessed from QC summaries. For the MCW site, only field analytical data will be validated. The validation process will be abbreviated to include a review of calibration records, sample data results from readouts or field notes, and duplicate measurement precision.

4.0 RECORDS

An important factor in operating any efficient extraction and treatment system is the maintenance of accurate operational and financial records. Without a record of past operational performance, it is impossible to identify trends in any process. Records provide the operators and federal and state regulatory agencies with valuable information upon which to base their decisions concerning the system operation.

The operator should use the records as a guide in regulating, adjusting, and modifying system operation. They are also important in establishing a reliable continuing record of proof of performance and justifying decisions, expenditures, and recommendations. Maintenance records provide LDEQ with important information concerning the equipment history, parts requirements, and preventative maintenance supplies needed.

Four types of records are maintained at the MCW site: operating reports, maintenance records, emergency condition records, and personnel records. Some examples of record formats that could be used for the MCW DNAPL recovery system and WWTP are presented in the following sections.

4.1 OPERATING REPORTS

The operating reports to be maintained for the DNAPL recovery system and WWTP are included as Figures 4-1 through 4-4. These reports can be used to record information that is integral to observing and controlling operational trends of the DNAPL recovery system and WWTP.

The Maintenance Report (see Figure 4-1), the Daily Inspection Record (see Figure 4-2), and the Monthly Operating Report (see Figure 4-3) contain information extracted from work orders for specific maintenance activities and reports of completion. The Maintenance Work Order (see Figure 4-4) provides information from which the report data can be extracted. Tabulations of labor and materials

FIGURE 4-1

**MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM
AND WASTEWATER TREATMENT PLANT
MAINTENANCE REPORT**

Report Data:
Maintenance Type:
Work Order No.:
Work Order Date:

Date Repair Started	Date Repair Completed	Component Repaired	Parts and Materials	Labor Hours	Labor Category

Remarks/Resolution:

Name

Signature

FIGURE 4-2

MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM
AND WASTEWATER TREATMENT PLANT
DAILY INSPECTION REPORT

Date:____________________________ Page No.__________

Inspector Name:______________________ Signature______________________

Component	Activity (1)										Remarks-Resolution
	1	2	3	4	5	6	7	8	9	10	

FIGURE 4-2 (Continued)

**MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM
AND WASTEWATER TREATMENT PLANT
DAILY INSPECTION REPORT**

ACTIVITY

1. Alarm
2. Neighbor complaint
3. Power failure/general
4. Power failure/individual
5. DNAPL transfer line leak
6. Preventative maintenance
7. Sand filter backwash
8. Sand filter media replacement
9. Carbon filter media replacement
10. Other

FIGURE 4-3

MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM AND
WASTEWATER TREATMENT PLANT
MONTHLY OPERATING REPORT

Month of __________________, 20___

Day	Gallons Pumped										Hours of Operation	Comments
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
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31												

FIGURE 4-4

**MADISONVILLE CREOSOTE WORKS
DENSE NONAQUEOUS-PHASE LIQUID RECOVERY SYSTEM
AND WASTEWATER TREATMENT PLANT
MAINTENANCE WORK ORDER**

Report Date:	Requested By:
Report No.:	Equipment:
Work Number:	Building:
Activity:	Equipment Location:
Priority: Maintenance Type:	Serial No.: Problem:
Authority No.:	
Date:	

Comments:	
Special Instructions:	
Date Assigned:	Assigned to:
Date Completed:	Completed by:
Hrs/Miles	

Job Class	Hours	Vehicle	Hrs/Miles

used will aid in budgeting for future operations. Analysis of activity trends will aid future planning to overcome system weaknesses and promote system strengths.

4.2 MAINTENANCE RECORDS

Record completion and retention is the most important aspect of the maintenance program. From a review of the maintenance records, operating personnel, the responsible regulatory agency, and the design engineer can identify recurring problems with various pieces of equipment, select the appropriate list of spare parts to be maintained on site, and develop and design solutions to overcome these problems. Such records may be kept on cards, one card for each piece of equipment and pump installation. On these cards, a record should be kept of regular periodic service, equipment inspections, cleaning and replacement of worn parts, and other data that is felt to be of importance to record. The date when the next regular servicing of the equipment is scheduled should appear on the card where it can be easily seen.

For certain equipment, in addition to the cards, a lubrication record should be kept. On this record, the equipment is listed, as well as instructions for lubricating, including the type of oil or grease suggested and the frequency of lubrication. From this record the maintenance supervisor should be able to see when equipment should be lubricated again. A very helpful scheme for planning preventative maintenance is to review the maintenance cards and set up, ahead of time, list of operations to be performed on certain dates. The extruded grease should always be collected and properly disposed.

4.2.1 Equipment Information Card

This card should contain all the pertinent information on each piece of equipment. Such information is useful in ordering spare and replacement parts. Each time a unit is replaced by a spare, a new card should be prepared for the spare unit and the replaced unit in order to maintain a record of the location of each unit.

4.2.2 Equipment Inspection and Service Record

The equipment inspection and service record provides a list of work to be done on the equipment (see Figure 4-5). Data concerning the preventive maintenance necessary on each item of equipment is obtained from the manufacturer’s O&M manuals. A list of the lubricants needed; the lubrication schedule; spare parts needed; the daily, weekly, monthly, and annual routine maintenance; troubleshooting charts for their equipment; and other pertinent data for each piece of equipment is included. This list is also referenced to the preventive maintenance manual by volume number, item number, frequency of the work (weekly, monthly, and annual), and the time the work is to be performed. The back of the table provides space for the workman to show the date the work was done and sign the table, thereby verifying that the work has been performed.

4.3 EMERGENCY CONDITION RECORDS

A record of major emergency conditions affecting the system will be maintained (see Figure 4-6). This record should include area wide power failures, extraction pump failures, or natural disasters. It should also serve as a register of major emergencies or alarm conditions, with supplemental reports filed describing the occurrence, damage cause, emergency corrective actions taken, costs attributed to the situation, and permanent corrective actions taken, if required.

4.4 PERSONNEL RECORDS

A folder containing pertinent information on each employee should be maintained at the MCW site. Figure 4-7 is a suggested format to be used in setting up the record.

FIGURE 4-5

MADISONVILLE CREOSOTE WORKS AND SUPERFUND SITE
EQUIPMENT DESCRIPTION AND PREVENTIVE MAINTENANCE RECORD

Equipment Description: Preventive Maintenance to be done by:			
Item	**Work to be done**	**Reference**	**Frequency**

FIGURE 4-6

MADISONVILLE CREOSOTE WORKS AND SUPERFUND SITE EQUIPMENT INSPECTION AND SERVICE COMPLETION RECORD

SERVICE RECORD		
Date	**Work done**	**Signed**

FIGURE 4-7

MADISONVILLE CREOSOTE WORKS
MAJOR EMERGENCY CONDITION LOG SHEET

Emergency Conditions	Date	Time	Responding Operator	Corrective Action or Repairs

FIGURE 4-8

MADISONVILLE CREOSOTE WORKS
PERSONNEL RECORD

Name:	Date Employed:
	Social Security No.:
	Home Phone:
Persons(s) to Notify in Case of Emergency:	
(1)	(2)
Address:	Address:
Phone:	Phone:
Medical/Physical Condition (Allergies, Medication, disabilities, etc.)	
Job Assignment History:	
Special Awards, Study Courses, Other Recognitions:	

5.0 PERSONNEL

This section discusses personnel needs and responsibilities for the DNAPL recovery system and the WWTP. Personnel operating the DNAPL recovery system and WWTP will have different responsibilities than managerial personnel. These responsibilities are detailed below.

5.1 MANAGEMENT RESPONSIBILITY

Managerial responsibilities include the encouragement and motivation of O&M personnel, as well as overall supervision of the system. Specific responsibilities include but are not limited to:

- Ensure the efficient O&M of the system.
- Monitor the adequacy and content of the O&M records.
- Establish staff requirements, job descriptions, and personnel assignments.
- Provide O&M personnel with sufficient resources to properly operate and maintain the system.
- Provide adequate working conditions, safety equipment, and necessary tools for O&M personnel.
- Establish and maintain a harmonious working relationship with O&M personnel.
- Establish and maintain a training program for O&M personnel.
- Communicate importance of proper system performance to O&M personnel.
- Conduct periodic inspections of the system to discuss mutual problems with maintenance personnel and observe operational practices.
- Motivate personnel to achieve maximum operational efficiency.
- Prepare budgets and reports.
- Maintain good public relations.

5.2 OPERATING PERSONNEL RESPONSIBILITY

Operating personnel are responsible for the day-to-day O&M of the system. Specific responsibilities include but are not limited to:

- Knowledge of proper operational procedures.
- Effective operation of the system.
- Keep continuously updated on the best O&M practices.
- Maintain accurate and legible system O&M records.
- Inform management of potential major problems in O&M of the system.
- Monitor the condition of the sand and GAC in their respective canisters and replace when necessary.
- Be aware of safety hazards and take necessary steps to avoid them.
- Maintain creosote extraction pumps, valves, and all ancillary equipment needed for proper operation of the entire system.
- Inspect the transfer line from extraction well vaults and product lines inside of the WWTP building periodically.
- Be prepared to discuss the system operation with visiting personnel.

6.0 HEALTH AND SAFETY

Health and safety procedures associated with the O&M of the DNAPL recovery system and WWTP are to be addressed with an operator specific health and safety plan.

While the DNAPL recovery system and WWTP are operated by Tetra Tech and Eagle Construction and Environmental Services, Inc. (Eagle), O&M activities will be conducted in accordance with the Eagle site health and safety plan.

Future operators will need to generate their own site-specific health and safety plan. This plan will need to include, at a minimum, sections that address the following:

- Site location, description, and background
- Emergency contact list
- Personnel responsibilities
    - Site health and safety officer
    - Site supervisor
    - WWTP operator
    - Sampling technician
    - DNAPL recovery system and WWTP technician
- Physical hazards
- Heat-related hazards
- Noise
- Lifting hazards
- Heavy equipment hazards
- Slip, trip, and fall hazard
- Electrical hazards
- Fire and explosion hazards
- Chemical hazards
- Contingency plans

- Personnel roles and responsibilities
- Evacuation procedures
- Emergency medical treatment
- Fire and explosion procedures
- Spill control
- Emergency equipment
- Protection of the public
- Emergency contract information

C Hot work procedures and permits

C Confined space entry procedures and permits

C Employee training requirements

C Personal protection equipment requirements and procedures

C Medical surveillance

C Chemical hazard action levels

C Personnel and equipment decontamination procedures

C Proper labeling of process and electrical equipment

All personnel involved in the completion of the activities described in this plan should have received training in accordance with Occupational Safety and Health Administration 1910.120, including 40 hour initial Hazardous Waste Site Worker certification with a current 8-hour annual refresher. These personnel should also be participants in an approved medical surveillance program.

APPENDIX A.1

EXTRACTION PUMP OPERATION AND MAINTENANCE MANUAL

(31 Pages)

APPENDIX A.2

ULTRASONIC LEVEL METER OPERATION AND MAINTENANCE MANUAL

(53 Sheets)

APPENDIX A.3

RADIO FREQUENCY LEVEL METER OPERATION AND MAINTENANCE MANUAL

(20 Sheets)

APPENDIX A.4

DENSE NONAQUEOUS-PHASE LIQUID RECOVERY RISER FLOW METER OPERATION AND MAINTENANCE MANUAL

(Eight Pages)

APPENDIX A.5

DNAPL TRANSFER PIPELINE CUTSHEET DATA

(27 Pages)

APPENDIX A.6

EQUALIZATION TANK CUTSHEET DATA

(Two Pages)

APPENDIX A.7

OIL WATER SEPARATOR OPERATION AND MAINTENANCE MANUAL

(81 Pages)

APPENDIX A.8

DNAPL STORAGE TANK CUTSHEET DATA

(Two Pages)

APPENDIX A.9

LIGHT NONAQUEOUS PHASE LIQUIDS STORAGE TANK CUTSHEET DATA

(Two Pages)

APPENDIX A.10

SAND FILTER OPERATION AND MAINTENANCE MANUAL

(Five Pages)

APPENDIX A.11

LIQUID-PHASE ACTIVATED CARBON OPERATION AND MAINTENANCE MANUAL

(Twelve Pages)

APPENDIX A.12

BACKWASH TANK CUTSHEET DATA

(Two Pages)

APPENDIX A.13

VAPOR-PHASE ACTIVATED CARBON CUTSHEET DATA

(Five Pages)

APPENDIX A.14

POSITIVE DISPLACEMENT PUMP OPERATION AND MAINTENANCE MANUAL

(32 Pages)

APPENDIX A.15

CENTRIFUGAL PUMP OPERATION AND MAINTENANCE MANUAL

(28 Pages)

APPENDIX A.16

DECONTAMINATION SUMP PUMP CUTSHEET DATA

(Two Pages)

APPENDIX A.17

CONTINUOUS ULTRASONIC LEVEL METER OPERATION AND MAINTENANCE MANUAL

(49 Sheets)

APPENDIX A.18

CONTINUOUS RF LEVEL METER OPERATION AND MAINTENANCE MANUAL

(37 Pages)

APPENDIX A.19

THREE-POINT RF LEVEL METER OPERATION AND MAINTENANCE MANUAL

(Two Pages)

APPENDIX A.20

MAGNETIC FLOW METER OPERATION AND MAINTENANCE MANUAL

(104 Pages)

APPENDIX A.21

PIPING CUTSHEETS

(14 Pages)

APPENDIX A.22

VALVE CUTSHEET DATA

(Five Pages)

APPENDIX A.23

PROGRAMMABLE LOGIC CONTROLLER OPERATION AND MAINTENANCE MANUAL AND INPUT/OUTPUT WIRING DIAGRAMS

(223 Pages)

APPENDIX A.24

SUMP LEVEL SWITCH CUTSHEET DATA

(Four Pages)

APPENDIX A.25

LEAK DETECTION SYSTEM OPERATION AND MAINTENANCE MANUAL

(13 Pages)

APPENDIX A.26

WATER WELL SYSTEM OPERATION AND MAINTENANCE MANUAL

(50 Pages)

APPENDIX A.27

PRESSURE INDICATOR CUTSHEET DATA

(Five Pages)

APPENDIX A.28

VARIABLE FREQUENCY DRIVE OPERATION AND MAINTENANCE MANUAL

(137 Pages)

APPENDIX A.29

WASTEWATER TREATMENT BUILDING WARRANTY AND CUTSHEET DATA

(Seven Pages)

APPENDIX A.30

MONITORING WELL CONSTRUCTION DRAWINGS

(Five Pages)

APPENDIX B

MAINTENANCE AND INSPECTION RECORDS

(To be Compiled During Operation)

APPENDIX C

AS-BUILT CONSTRUCTION DRAWINGS

(28 Sheets)

APPENDIX D

STANDARD OPERATING PROCEDURES

(67 Pages)

EXHIBITS

(22 PAGES)